SCIENCE

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*OUR SOCIETY.**

SEVERAL travellers of the eighteenth century, among them especially Guettard, Alexander and Schoepf, gave more or less important information respecting the geological structure and mineral resources of our country; but geological work, properly so-called, began only with Maclure's studies in 1806. Born in Scotland, Maclure came to this country in early youth and, embarking in business, acquired a fortune long before reaching middle age. He returned to Europe to spend several years in the study of natural science, but came again to America in 1806 to take up his geological work, which continued until 1808.

The publication of his results, presented to the American Philosophical Society on January 20, 1809, led others to make studies and soon afterwards there appeared numerous papers dealing with geological subjects. Professor Samuel L. Mitchell, a devoted follower of Werner, infused much of his enthusiasm into a group of youthful students in New York and induced Professor Archibald Bruce to establish the *American Journal of Mineralogy*, which, beginning in 1810, reached its fourth and last number in February, 1814. Though small and short-lived, this journal served a useful purpose; it contained good papers by

* Presidential address delivered at the annual meeting of the Geological Society of America, New York, December 28, 1898.

Akerly, Gibbs, Godon, Mitchell, Silliman and others; it did much to nurse the scientific tendency which led to founding the New York Lyceum of Natural History in 1817, and some have thought that it aided in like manner the founding of the Philadelphia Academy in 1812. *Bruce's Journal* was succeeded in 1818 by *Silliman's American Journal of Science*, which from the beginning exerted a notable influence upon the development of geological thought and work in our country.

By 1820 students of geology had become so numerous that the American Geological Society was organized in New Haven, Connecticut, where meetings were held certainly until the end of 1828. The last survivor of this Society died in New Haven only a few weeks before the formal organization of our Society in 1888. The prominent men in 1820 were Ackerly, Bruce, Cornelius, Cleveland, the two Danas, Dewey, Eaton, Gibbs, Godon, Hitchcock, Maclure, Mitchell, Rafinesque, Schoolcraft, Silliman and Steinhauer, but there were some young men who began to publish within two or three years afterwards and who were destined to occupy prominent places in geological literature; of these, Emmons, Harlan, Lea, Morton, Troost and Vanuxem were already engaged in investigation.

Before another decade had passed there were groups of geologists in New England, New York and Pennsylvania, while Olmstead and Vanuxem had made preliminary surveys in North Carolina and South Carolina, Troost had begun the survey of Tennessee and Hitchcock that of Massachusetts.

In 1832 the Pennsylvania geologists, feeling much in need of an official survey of their State, organized the Geological Society of Pennsylvania, to arouse public interest and so to bring about the survey. The volume of publications contains papers which attack geological and economic problems of the first order. The investigations were not confined to Pennsylvania, but committees were appointed to examine important matters in other States, that the worth of geological work might be made obvious. Beyond doubt, the efforts of this Society had much to do with securing the First Geological Survey of Pennsylvania, though no member of the Society was appointed on on the staff. It is the fashion now and then to laugh at these old papers. True enough, in the light of our present knowledge, many of the statements respecting Appalachian structure are absurd, but they were made by men who, without State aid, without instruments and without maps, laid a foundation upon which the keen-eyed men of the First Pennsylvania Survey built the superstructure, which endured close re-examination by the second survey and proved the honesty and ability with which the work had been performed.

But geology was becoming too broad in scope and its workers too numerous to be embraced in a merely local society, even though the list of correspondents was as large as that of the active members. The work in Massachusetts was approaching completion; that in New Jersey had been completed; the Surveys of Maine, Connecticut, New York, Pennsylvania, Maryland, Delaware, Virginia, Ohio, Michigan and Indiana had been begun, and before 1840 New Brunswick, Rhode Island and Kentucky were added to the list. Several of these Surveys had large corps of workers, pushing their studies with all the enthusiasm of a new calling. In the Appalachian region of Massachusetts, New York, Pennsylvania and Virginia serious problems were encountered which could not be solved within the compass of a single State. A right understanding of the work done in one State was necessary to a right understanding of the work done in the adjoining State. Correspondence proved a failure;

incidental or casual talks led to misunderstandings; systematic conference was necessary with generous contribution by each of his knowledge to the other.

On April 2, 1840, as the result of a conference held at Albany in 1839, eighteen geologists met at the Franklin Institute, Philadelphia, and organized the Association of American Geologists, with Professor Edward Hitchcock as the first Chairman; among these were the State Geologist of Massachusetts, six geologists of the New York Survey, six of the Pennsylvania Survey, two of the Michigan and three not connected with any public work. Mr. Martin H. Boye is the only survivor of the eighteen. The succeeding meetings in Philadelphia and Boston were attended by many geologists, of whom only Boye, O. P. Hubbard and J. P. Lesley remain. A volume published in 1843 contains several papers which made a deep impress on American geology; here are the five great memoirs on Appalachian conditions by the Rogers brothers; Hall's noteworthy discussion of the Mississippi basin section; Hitchcock's elaborate discussion of the 'Drift;' as well as numerous contributions by other members.

Professor Hall said on one occasion that the inspiriting effect of these meetings could not be overestimated. As one of the youngest members, he was impressed by the mental power of those great men, all untrained in geology, except Taylor, whose training under William Smith proved advantageous in many ways but very disadvantageous in others, as it had provided him with a generous stock of well-set opinions. Though wholly self-taught, working in a country sparsely settled, without barometers, without railroad cuts, oil borings, mine shafts or any of the advantages so necessary for us, those men had elaborated systems, had made broad generalizations, had learned much respecting the succession of life and had discovered the keys which, in later years, were to open mysterious recesses in European geology.

But the geologists were not permitted to flock by themselves. The advantages of contact were so manifest that the naturalists asserted their claims to relationship with sufficient energy to secure admission in 1841, and the name Association of American Geologists and Naturalists appeared in the constitution adopted at the 1842 meeting. The number of scientific men was still comparatively small, and in most of the colleges the several branches of natural science were embraced in one chair, so that there were many professors who could lay claim to the title of geologist, physicist, naturalist or chemist, as they pleased. Men of this type, as well as physicists, chemists and mathematicians, constantly urged the propriety of broadening the scope of the Association so as to admit workers in all branches of science.

In 1842 the first series of surveys practically came to an end, and the geologists were scattered, many of the younger men being compelled to enter other callings. The Association held its meetings regularly, but its strength diminished, and in 1848 it yielded to the outside pressure, becoming merged into the American Association for the Advancement of Science, which threw its doors wide open to all entertaining an interest in any branch of science. The first meeting of the new organization had a roll of 461 members.

Comparatively little was done in geological work between 1842 and the close of the Civil War. Professor Hall maintained the New York Survey, after a fashion, but at very considerable pecuniary cost to himself; surveys were carried on in a number of States, but, except in Illinois and California, they were mostly reconnaissances by small corps; the annual appropriations in several instances were little more than enough to pay travelling expenses, so that

the work and the reports were practically gifts to the States. The Federal Government sent topographic expeditions into the Western country, most of them accompanied by a surgeon who had more or less knowledge of geology. Under such conditions the number of geologists did not increase, and when the American Association was divided into sections, in 1875, the geologists and naturalists became not Section A, but Section B.

The rapid development of the country's internal resources during the war and the attendant growth in manufacturing interests made necessary increased efficiency in scientific training, and enormous gifts were made to our leading institutions for that purpose. The importance of geological knowledge had become very evident during the development of iron, coal and oil resources, and the geologist found himself elevated suddenly from a place surrounded by suspicion to a post of honor. As an outgrowth of the restless activity due to the war came anxiety to learn more accurately the resources of our Western domain beyond the 100th meridian. The War Department, through its Engineer Corps, organized the Fortieth Parallel Survey, in charge of Clarence King, and two years afterwards authorized Lieutenant (now Major) George M. Wheeler to undertake what afterwards became the United States Geographical Surveys West of the 100th Meridian. Mr. King's survey was primarily for geological work, that of Lieutenant Wheeler primarily for topographical work, but each in its own field did all the work, geological or topographical, necessary to the accomplishment of the allotted task. The Interior Department had charge of Dr. F. V. Hayden's surveys, beginning in 1867, as well as of the work prosecuted by Major J. W. Powell after 1870. The consolidation, in 1879, of all the organizations then existing put an end to useless rivalries and made possible the formation and execution of broad plans requiring a high grade of preparation in those engaged upon the work. But while these surveys were advancing in the Far West great activity prevailed in the older area. Within a decade after the war ended State Surveys were undertaken in New Hampshire, New Jersey, Pennsylvania, Ohio, Indiana, Kentucky, Michigan, Wisconsin, Minnesota, Iowa, Missouri and other States, while the Canadian Survey, which had gone on uninterruptedly from the early forties, was made more extended in character. Several of the State Surveys, being well supported by generous appropriations, employed large corps of assistants, paid and volunteer, and were prosecuted with great energy. Under these conditions Section E, that of Geology and Geography, grew rapidly and soon became one of the strongest portions of the American Association.

The conditions which rendered imperative an association of geologists in 1840 were the present conditions in 1880, but more oppressive. The problems of 1840 were chiefly those of a narrow strip within the Appalachian area; those of 1880 concerned the whole continent. Geologists were increasing in numbers, but opportunities for making personal acquaintance were few; meetings of societies in midsummer could be attended only by those who were not connected with official surveys or were detached for office work. Workers were gathering into little groups on geographical lines, and there was danger that our geology would become provincialized. Members of one group regarded those of another with a feeling not altogether unrelated to suspicion; letter-writing took the place of personal communication, with too often the not-unusual result of complete misunderstanding, with the attendant personal irritation or worse.

In 1881 the tension was such that several

geologists connected with official surveys urged the formation of a geological society to bring about closer bonds among geologists; and they succeeded, at the meeting of the American Association, in securing the appointment of a committee to consider the matter. The geologists of the country were consulted, and a report, showing that the consensus of the replies favored the organization of such a society, was presented in 1882 as well as in 1883, but without any result. The Association's Committee on the International Geological Congress considered the question in 1887 and announced approval. Professors N. H. Winchell and C. H. Hitchcock, as Chairman and Secretary of the 1881 Committee, issued a call asking geologists to assemble at Cleveland, Ohio, on August 14, 1888, to form a Geological Society.

A large number of geologists and other members of Section E assembled on the afternoon of that day. Professor Alex. Winchell presided and Dr. Julius Pohlman was Secretary. An earnest discussion respecting the type of society to be founded occupied most of the afternoon. The plan suggested in the call looked only to an expansion of Section E of the American Association by holding meetings at times better suited than summer to the convenience of geologists. But a difference of opinion quickly developed, for some knew that no such expedient would suffice, that the conditions called for something more definite. Loyalty to the American Association, which for forty years had been the bond between scientific men, held many back from an extreme position. Yet every one recognized that little injury could come to the Association, as, at best, only a few geologists could attend summer meetings. In any event, it was clear that the interests of geology required the formation of a society with severe restrictions upon membership and with publications which would be a credit to American science. A compromise prevailed, whereby the Original members, entitled to take part in organization, must be members of Section E of the American Association, and that all members of Section E might enroll prior to the first meeting if they so desired. This last provision caused not a little anxiety, as membership in any section of the Association predicates nothing more than a friendly feeling for science—whatever that may mean.

A committee* was appointed to prepare a plan of organization with a provisional constitution. The committee's report, on the morning of the 15th, provoked debate, as the provisional constitution placed a positive limit upon the membership by permitting, after the organization, only working geologists and teachers of geology to become members and by requiring a three-fourths vote for election. The organization was to be effected when the list of Original members contained one hundred names. The provisional constitution, with a few unimportant amendments, was agreed to unanimously and a committee continued as a committee of organization. The details of arrangements were placed in the hands of Professors A. Winchell and Stevenson.

Happily the high dues and general belief that no society could be formed on the proposed basis kept the list of Original Fellows from being swollen by those whose relation to geology began and ended with attendance upon the American Association's meetings. The committee was enabled from the very outset practically to choose the men who should make the society. The required number having been obtained by the 1st of December, a meeting was held at Ithaca, New York, on December 27, 1888. Only thirteen were pres-

* This committee consisted of Alexander Winchell, J. J. Stevenson, C. H. Hitchcock, John R. Procter and Edward Orton.

ent, but ballots of preference had been received from seventy-two Fellows, in accordance with which the organization was completed by the election of President, James Hall; Vice-Presidents, James D. Dana and Alexander Winchell; Secretary, John J. Stevenson; Treasurer, Henry S. Williams; Councillors, John S. Newberry, John W. Powell and Charles H. Hitchcock.

The matter of publication was discussed at great length, but no definite decision could be reached, and a committee was appointed to consider the whole question, with instructions to present a report at the summer meeting. Another committee was appointed to prepare a permanent constitution, to be presented at the next meeting.

The Advisory Committee on Publication, another name for Professor W J McGee, made an elaborate investigation of the whole question of publication and, in August at Toronto, presented the report, accompanied by a printed example of the form recommended. This report was adopted and, at the close of the following meeting, Dr. McGee was chosen as first Editor that the recommendations might be carried out faithfully. Our Bulletin, which marked a new stage in scientific publications, owes its excellence of form and accuracy of method to his indefatigable persistence. His determination to secure exactness in all respects proved not wholly satisfactory to many of us, but, before he demitted his charge, the justice of his requirements was conceded on all sides. The discipline to which the Fellows of this Society were subjected by the first Editor has served its purpose, and editors of other scientific publications have found their labors lightened and their hands strengthened in efforts to produce similar reforms elsewhere.

Fears and misgivings abounded when it was discovered that this Society was a success from the start. The American Association for the Advancement of Science had been the one society for so many years that attempts at differentiation seemed to be efforts to cut away the pillars of scientific order. But the fears were merely nightmare. Our Society has proved itself an efficient ally of the Association.

Our net membership at the close of the first year was 187. The new constitution placed severer restrictions upon membership by requiring a nine-tenths vote for election, the ballot being by correspondence and shared in by all the Fellows. This has kept the number within reasonable limits, and we now have 237 Fellows, our roll including almost all of those, who, by strict construction of our constitution, are qualified for membership. Owing to the rigid administration of our affairs by Professor Fairchild and Dr. White, who have piloted us for eight years, our financial condition is satisfactory, and the income from the permanent fund now goes far toward covering the cost of administration.

Throughout, the Society has held closely to investigation; the recondite problems, those of little interest to many, of no interest to most, are those which have held the attention of our Fellows—work in pure rather than in applied sciences; there has been no trenching upon the field of the mining engineer. As a storehouse of fact and of broad, just generalization the volumes of our Bulletin are excelled by those of no similar publication.

We close our first decade justly gratified by success and full of hope for the future. Some of those who led us and gave us reputation at the beginning are no longer with us; Hall, Dana and Winchell, the first three Presidents, passed away in reverse order; Cope, Cook, Sterry-Hunt, Newberry and a few others have gone from us, but the Society retains its membership with changes unusually small, showing no ordinary degree of physical force and *esprit du corps* on the part of its Fellows. As we look back

we recognize how far this Society has been of service to us as men; in not a few instances misunderstandings have been removed and coldness or suspicion has been replaced by personal friendship. American geologists are no longer a disorderly lot of irregulars marching in awkward squads, but form a reasonably compact body, though as individuals they may owe allegiance to Canada, the United States, Mexico or Brazil. Every one of us has felt the inspiriting influence of personal contact.

But our Society has to do with the world outside of itself and outside of its immediate line of thought. It must have more to do with that world in the future if the outcome for science is to be what it should be, for the time is approaching rapidly when we must seek large sums for aid in prosecuting our work. To retain the respect of the community and to retain influence for good we must be able to justify the existence of a society devoted to investigation as distinguished from application. The question *Cui bono?* will be asked, and the answer cannot be avoided.

This is a utilitarian age—not utilitarian as understood by those who bemoan the decay of æsthetic taste; or of those who feel that in the passing of Aristotle and Seneca there has come the loss of intellectual refinement; or of those others who bewail the degeneracy of a generation which has not produced a Kant, a Newton, an Aristotle, a Laplace, a Humboldt or an Agassiz; all regarding the decadence as due to the degrading influence of material development and overpowering commercial interests.

These pessimists stand at a poor point of view, where the angle of vision is narrowed by many lateral projections. One may say, without fear of successful contradiction, that, in so far as actual knowledge is concerned, students of our day receiving graduate degrees in the more advanced universities stand on a somewhat higher plane, each in his own group, than did the celebrated men just named. The student now reaches beyond where they ended, and still is at only the threshold; for, in most instances, years of labor are required of him before he can receive recognition as an efficient co-worker. Men towering far above their fellows and covering the whole field of knowledge will never be known again. Kant, Newton, Humboldt stand out from their fellows as sharply as lighthouses on a level shore; but there are many Kants, Newtons and Humboldts to-day. Prior to the last seventy-five years the field of actual knowledge was insignificant and a man possessing large powers of observation grasped the whole. Seventy-five years ago one man was expected to cover the whole field of natural science in an American college. Should any man pretend to-day to possess such ability he would expose himself to ridicule.

It may be true that this century has given to the world no great philosopher—that is, no great philosopher after the old pattern. But one must not forget that philosophy has to face a difficulty which was unknown in the last century. The unrestrained soaring of philosophers into the far-away regions of mysticism is no longer possible, for facts abound and the knowledge which is abroad in the land must be considered in any well constructed system. Some have maintained, if not in direct statement, certainly in effect, that study of material things unfits one for metaphysical investigation. Undoubtedly it would hamper him in some kinds of metaphysical research, as it would fetter him with a respect for actualities, but it would fit him well for other kinds. Aristotle, Kant and, in our own time, McCosh and Spencer attained to high position as philosophers and in each case possessed remarkable knowledge in respect to material things.

The assertion of lost intellectual refinement and of depraved æsthetic taste is but the wail for an abandoned cult. It is but a variation of the familiar song which has sounded down the generations. The world was going to destruction when copper ceased to be legal tender, as well as when Latin ceased to be the language of university lectures; art disappeared when men ceased idealizing and began to paint nature as it is; religion was doomed to contempt when the Bible was translated into the vulgar tongue; and the pillars of the earth were removed when the American Republic was established.

But in a proper sense this is a utilitarian age. Everywhere the feeling grows that the earth is for man, for the rich and for the poor alike; that those things only are good which benefit mankind by elevating the mental or physical conditions. Until the present century the importance of the purely intellectual side of man was overestimated by scholars, and matters connected with his material side were contemned. With our century the reaction was too great, for even educated men sneered at abstract studies as absurdities, while they thought material things alone worthy of investigation. But the balance is steadying itself, and at each oscillation the index approaches more closely to the mean between the so-called intellectual and material sides. Devotees of pure science no longer regard devotees of applied science as rather distant relations who have taken up with low-born associates.

There appears, at first glance, to be very little connection between great manufacturing interests, on one hand, and stone pecking at the roadside or the counting of striæ on a fossil, on the other. Yet a geologist rarely publishes the results of a vacation study without enabling somebody else to improve his condition. About twenty years ago one of our Fellows began to give the results of reconnaissance studies made during vacations. These concerned certain fault lines, and the notes included studies upon coal beds and other matters of economic interest involved in the faults. The coal beds were all bought up; railroads were constructed; mines were operated; towns were built; a great population was supplied with work at good wages, and many men were enriched. But according to the latest information no one has offered to re-imburse the geologist his expenses, nor has any paper in the whole region suggested that the geologist had anything to do with bringing about the development.

Geological work in this as in other lands was originally vacation work, but eventually the investigations became too extensive and the problems too broad for the usually limited means of the students. Meanwhile, it became manifest, as in the case just referred to, that important economic results were almost certain to follow publication of matters discovered by geologists, so that men interested in economics were ready to assist in securing State aid to advance geological work. As one of our Fellows remarked the other day, economic geology has been the breastwerk behind which scientific geology has been developed by State aid.

Ducatel's reconnaissance proved the importance of Maryland's coal field and the survey was ordered; the Pennsylvania Geological Society discussed coal fields until the Legislature gave the State a survey; the geologists of New York promised to settle, finally, the question of the occurrence of coal within the State; and so in many other States.

The United States Geological Survey had a somewhat different origin, for the economic side did not attain importance until a late period. Soon after the annexation of California the necessity for railroad communication with the Pacific became appar-

ent, and Congress ordered exploration of several lines across the Rocky Mountain region. At that time, the early 'fifties, the perplexities of American geologists had reached a maximum. Most of the old State surveys had come to a close, rich in economic results and still richer in problems to be solved only by elaborate investigation, too extended and too costly for those days. The observations made by Wislezenus and army officers in New Mexico, by Fremont and Stansbury farther north in the Rocky Mountain and Plateau regions, as well as by Culbertson and Norwood in the Dakota country, had stirred the curiosity and awakened the interest of geologists everywhere. Strong pressure was brought to bear on the Secretary of War for the appointment of geologists to positions on the several parties. The efforts were successful and the appointments were made, though in most instances the geologists were physicians and appointed as acting surgeons in the army. This was an important advance in scientific work, for, almost without exception, exploring parties under the War Department from that time were accompanied by naturalists. The Civil War brought the Western work to a close, but when peace returned it was taken up again and geology was recognized as a necessary part of it, until at last the fragmentary works were placed in one organization and the Survey established as it now exists.

In all of the later geological surveys the element of economics entered more largely into consideration and was emphasized in the legislative enactments. Men recognized that geological investigation had led to the discovery of laws, most important from the economic standpoint, and they were anxious to have the knowledge utilized in a broad way.

Looking over the history of the old surveys one sees clearly that their origin was due solely to a desire for solution of problems in pure science. The credit for the economic outcome of the scientific work is due to the geologist alone, to whom the appropriations were given, practically as a gift. The Legislators soothed their consciences by lofty speeches respecting the duty of the Commonwealth to foster the study of Nature, but they generally had an aside to be utilized as a justification before their constituents—"especially when there is a very reasonable chance that something of value will be discovered to the advantage of our Commonwealth."

The New York survey had for its possible outcome the determination of the coal area. The work was completed with great exactness, for it proved that the State contains no coal area whatever. Though only negative in results for the State, this survey has proved of incalculable service to the country at large, for it first elaborated the lower and middle Paleozoic sections; the scientific work, continued along the biological line, defined accurately the vertical limits of fossils and provided means for removal of difficulties where the succession is incomplete and for tentative correlation in widely separated localities, an apparatus whose usefulness cannot be overestimated from an economic standpoint.

If the man who makes two blades of grass grow where only one grew before be a public benefactor, what shall be said of the geologist who turns a desert into a garden? This was done by the first survey of New Jersey, which differentiated and mapped the marls of that State, giving a complete discussion of their nature and value. Great areas of the 'whites and barrens' have been converted not into mere farm lands, but into richly productive garden spots. In later years the second survey, now almost forty years old, did, as it is still doing, admirable work along the same lines; the study of structural geology gave a clue to the causes of restrained drainage, and in not a few in-

stances showed that relief from malaria could be obtained with unsuspected ease, and that many miles of noxious swamp could be converted into lands well fitted for residence.

The first survey of Pennsylvania was purely scientific in inception and execution. Economic questions had little of interest for its head, and in the work their place was very subordinate to those in pure science; yet the outcome was inevitable. The study of the Appalachian folds and the discovery of the steeper northwesterly dip revealed the structure of the anthracite region and made it possible to determine the relations of the anthracite beds; the vast extent of the bituminous area and the importance of the Pittsburg coal bed were ascertained during the search for facts to explain the origin of the coal measures; the ores of the central part of the State were studied with rigorous attention to detail that the problem of their origin might be solved. But these and other scientific studies brought out a mass of facts which were seen at once to possess immense importance, and the reports were published broadcast. New industries were established; old ones, previously uncertain, became certain and developed prodigiously; the coal and iron interests moved at once to the front, so that, within two or three years after the survey ended, 'Tariff' became the burning political question throughout the State. The results of the second survey were even more remarkable in their influence upon the development of the Commonwealth and the increased comfort of the population.

Among the earliest results of the first survey of Michigan was the determination of the value of the salt lands and the announcement of iron ore in the Upper Peninsula. The successors to this survey, but under the United States supervision, made studies of numerous localities and determined the excellence of the ores. Unquestionably, the importance of the deposit became known to capitalists very largely through the reports of this survey, though at that time economic geology had no charms for its head. Much of the enormous development of the Lake Superior iron region was due to the influence of the later survey between 1869 and 1873.

The first Ohio survey, made sixty years ago, was at greater disadvantage than the Pennsylvania survey, yet in the first year the coal area was defined and during the second the geologists determined the distribution of the several limestones and sandstones which, as building stones, have become so important. The second survey was made effective at once by the tracing and identification of the Hocking Valley coal, which brought into the State a vast amount of new capital and changed the face of a great district. The third survey determined the distribution of oil and gas, the relations of the coal beds and the characteristics of the clay deposits in such fashion as to remake the manufacturing interests of the State.

The Mesabi and Vermilion ranges of Minnesota contain deposits of iron ore which, for the present at least, appear to be even more important than those of northern Michigan. Almost fifty years ago J. G. Norwood, while studying the easterly end of the region, discovered the Mesabi ores; a few years later Whittlesey, after a detailed examination farther west, predicted the discovery of similar ores, a discovery actually made in 1866 by Eames, who was then State Geologist and engaged in studying the Vermilion range. Though not utilized at once, these announcements were not forgotten and systematic exploration was begun in 1875, when the need of high-grade ores at low prices made necessary the opening of new areas. Almost at once, the State Geological Survey determined the extent of the ore-bearing region,

differentiated the deposits and removed erroneous impressions respecting the extent and distribution of the ores. The effect of discussion and of the positive fixing of areas has been to increase development and to cheapen ores of the best quality so far that Bessemer steel can be manufactured more cheaply in the United States than elsewhere, in spite of the fact that wages are still higher, not simply numerically, but in purchasing power, than in any other iron-producing country. An examination of the reports which have brought about this result compels one to say that the anxiety for economic results does not appear to have been an impelling motive during the work. There were perplexing geological problems to be worked out, and the solutions could be discovered only by the most painstaking work. This investigation led to the economic results.

The United States Survey retained its original character for a number of years, the studies being devoted almost wholly to pure science. There were those who looked upon the elaborate petrographical work as merely an elaborate waste of public funds; who, like the member of the Ohio Legislature, regarded fossils only as 'clams and salamanders' and considered the diagrams of sections as merely bewildering humbug, while they asserted that attention ought to be given to other matters, which, however, they were not always ready to designate. But the outcome of these studies was the inevitable; petrography has its applications now in the investigation of building stones, and it has proved of service in aiding to determine the source of precious metals at more than one important locality. The determination of fossils has led to the proper definition of the great coal horizons of the Upper Cretaceous; the close study of stratigraphical relations made possible a wide development of artesian well systems in the Dakotas, just as similar work in England led to the same practical result; while the study of climatic and structural conditions was brought to bear on the great problem of our arid lands with no mean results.

But these illustrations must suffice, not because they exhaust the material—for every official survey on the continent affords illustrations—but because this is an address, not a history, and already the time allotted has been exceeded.

It is the old story—the same in geology as in other branches. The kind of work for which this Society stands lies more closely to the welfare of the community than is supposed even by men in high position and of far more than average intelligence. This work is responsible in large part for the industrial progress of our continent, which we must regard, in spite of protests from those who lament the dominance of commercialism, as the force which has made possible our great advance in physical comfort as well as the equally great advance in literary culture and æsthetic taste. Coal, iron and oil, chief among our products, have been so much the objects of minute study by closet investigators that improvement in processes of manufacture has not been a growth, but rather a series of leaps.

We give all honor to applied science, yet we cannot forget that it is but a follower of pure science. The worker in pure science discovers; his fellow in applied science utilizes; the former receives little credit outside of a narrow circle; pecuniary reward is not his object and rarely falls to his lot; the latter has a double possibility as an incentive, large pecuniary reward and popular reputation in case of noteworthy success. The two conditions are well represented by Henry, the investigator, and Morse, the inventor and promoter.

Men are ignorant of their debt to closet workers because the facts have never been

presented. As geologists and as citizens of no mean countries we ought to present this matter clearly to men whose fortunes have come through application of principles discovered by obscure workers. Such men are quick to perceive the justice of the claim and usually are ready to pay a reasonable interest on the debt.

The world must advance or retrograde; it cannot stand still. Continued advance in physical comfort and intellectual power can come only through intenser application to investigation along the lines of pure science, which can be made possible only by affording increased opportunities for research in our colleges and by the expansion of research funds held by societies such as this.

John J. Stevenson.
New York University.

FISHES OF THE SOUTH SHORE OF LONG ISLAND.

Investigations carried on by the New York State Museum from July to September and continued by the U. S. Fish Commission until near the close of October, 1898, in the waters of the southern part of Long Island resulted in the collection of eighty-four species of fishes belonging to the region.

The work of collecting began July 21st, at Southampton, from which place excursions were made to Shinnecock, Mecox and Peconic Bays and to the ocean beach. The writer was assisted by Mr. Barton A. Bean, on behalf of the U. S. National Museum, during the first month of the explorations. Great South Bay was the scene of operations from August 12th until October 19th.

Fine-meshed seines, a gill net of two-inch stretch-mesh and a trawl line with about 200 hooks were the principal means of capturing the fishes, and a few interesting species were obtained from the haul seines and set nets of fishermen on the ocean beach and the pound nets in Great South Bay.

A noteworthy feature was the absence of many fishes which had been taken during the summer and fall months in previous years. Among them are: *Albula vulpes*, *Etrumeus sadina*, *Clupea harengus*, *Pomolobus æstivalis*, *Stolephorus argyrophanus*, *Fistularia tabacaria*, *Sphyræna borealis*, *Decapterus punctatus*, *Vomer setipinnis*, *Trachinotus falcatus*, *Trachinotus argenteus*, *Lagodon rhomboides*, *Leiostomus xanthurus*, *Acanthocottus æneus*, *Hemitripterus americanus* and *Platophrys ocellatus*. Two things contributed to this condition, the prevalence of southerly winds, causing rough seas on the ocean beaches, and high water temperature which kept the migratory fishes well to the north of Long Island until late in October. A very serious hindrance to seining in most parts of the bays was the abundance of living and dead sea weeds near the shores, and another great obstacle was found in the sunken stakes scattered by ice and storms from the fences used as sea-weed collectors.

The sand shark (*Carcharias littoralis*) was abundant on the grassy shallows south of Toby's Flat until the middle of September, when it migrated westward. It preyed upon mullet, eels and flatfish, and, on account of its habit of swimming slowly near the surface, was easily captured by spears from a row boat. A young mackerel shark (*Lamna cornubica*), about three feet long, was caught in a gill net set in the ocean off Southampton. Other sharks secured were the dusky shark (*Carcharhinus obscurus*), the smooth dogfish (*Mustelus canis*) and the horned dogfish (*Squalus acanthias*).

The skates represented three species, *Raja erinacea*, *ocellata* and *eglanteria*, all of which were sufficiently common. They were often found feeding in shallow water near the shores, especially in the evening and night. A large male was taken by the hands, on the night of October 17th, in a

small dug-out creek emptying into Clam Pond Cove. It was at the edge of the shore and partly out of water, having followed the channel to the head of the creek and then failed to discover a way out.

A large menhaden (*Brevoortia tyrannus*) was captured by an osprey in Great South Bay and carried through the air fully two miles. The osprey was struck by a charge of shot and dropped its prey, which was then found to be alive. The young of the menhaden were migrating westward in large schools, swimming near the surface of the bay, on October 1st.

The lizard fish (*Synodus fœtens*), which was obtained almost everywhere in Great South Bay in 1890, was almost entirely absent, only a single example having been secured.

The half-beak (*Hyporhamphus roberti*) was found in small numbers and was occasionally seen swimming in the water. Its movements are closely similar to those of the silver gar (*Tylosurus marinus*). This is one of the species captured at night by the use of a large reflector lantern. The light apparently dazes the fish so that it can easily be taken out of the water with a dip-net.

The small silverside (*Menidia beryllina*) occurs abundantly in fresh and brackish waters throughout the region explored and was once seined in salt water near Fire Island. On September 24th a young individual from Swan River measured one and one-sixteenth inches in length. The rough silverside (*Kirtlandia laciniata*) was added to the New York fauna by the capture of an adult example in Mecox Bay, August 1st. This has the following characters: D. V, I, 7 ; A, I, 20; P. 14 ; V, I, 5 ; scales 7—47. It was associated with the common silverside (*Menidia notata*).

The red mullet (*Mullus auratus*) was obtained, October 17th, from a fish pound near Clam Pond Cove. Although the species occurs occasionally as far north as Cape Cod, it seems to be recorded now for the first time from Long Island. It was seined by the writer at Sandy Hook, October 8, 1897, and was reported by fishermen to have been abundant there in September and October of that year.

The saurel (*Trachurus trachurus*) was secured in a gill net, October 16th, in Clam Pond Cove, along with young bluefish and menhaden. Young horse-crevallé (*Caranx hippos*) were obtained at several localities in Great South Bay, and the common crevallé (*Caranx crysos*) was brought from a pound near Clam Pond Cove late in October. The thread-fish (*Alectis ciliaris*) is represented by two individuals from a pound near Islip. The look-down (*Selene vomer*) was seined at Duncan's Creek, August 29th. The common compano (*Trachinotus carolinus*) made its appearance in October in the vicinity of Fire Island Inlet. Only the young were obtained.

The black rudder fish (*Palinurichthys perciformis*), usually occurring off shore under floating logs and boxes, made its way into Great South Bay, and one example was caught in Clam Pond Cove, October 11th, by Captain George Yarrington. *Eucinostomus gula*, formerly so abundant in northern waters in mid-summer, is represented in the collection by a single, very small individual, seined in Clam Pond Cove, August 22d.

The yellow tail or silver perch (*Bairdiella chrysura*), which was plentiful in all parts of Great South Bay in 1890, proved to be scarce everywhere except at Nichols' Point, where the young were collected in moderate numbers, September 1st.

A single *Chætodon* (*C. ocellatus*) was obtained from a pound near Clam Pond Cove, October 17th. This is conspicuously beautiful on account of the orange color of its fins contrasting sharply with the dark bands on the head and body. The species was taken

also in Gravesend Bay in October, by Mr. W. I. De Nyse, who informs me that the roundish black spot in the soft dorsal remains fixed under all conditions, while the band extending from it to the anal fin sometimes disappears. The whole body of the fish at times appears to have an orange tinge, but at other times it is gray.

The rabbit-fish (*Lagocephalus lævigatus*) was not seen until October 14th, when a large individual was received from a pound near Clam Pond Cove. This was the only one obtained during the season.

The small-mouthed flounder (*Citharichthys microstomus*) was found in and near Fire Island Inlet on September 30th and October 11th. Ten individuals were taken, of which the largest is about four inches long. In 1890 this species was more abundant and occurred as far west as the Blue Point Life-Saving Station. In 1898 all but one of the recorded specimens were collected in a single haul of the seine.

The following record will serve as an illustration of the sudden changes occurring during the fall migrations: On October 11th, with southerly winds shifting to southwesterly and strong, two hauls were made with the gill net and three with the twenty-fathom seine; the fishes obtained were *Mugil cephalus*, *Mugil curema*, *Alutera schœpfii*, *Prionotus carolinus*, *Prionotus strigatus*, *Menidia notata*, *Fundulus majalis*, *Fundulus heteroclitus*, *Tautoga onitis* young, *Tylosurus marinus*, *Spheroides maculatus*, *Siphostoma fuscum*, *Hippocampus hudsonius*, *Citharichthys microstomus*, *Pseudopleuronectes americanus*, *Bothus maculatus*, *Stenotomus chrysops* young, *Synodus fœtens*, *Menticirrhus saxatilis*, *Centropristes striatus* young. To these were added, on the same day, at Clam Pond Cove, several miles farther east, *Palinurichthys perciformis*, *Pomatomus saltatrix*, *Opsanus tau*, *Brevoortia tyrannus* young, and *Bairdiella chrysura*. On October 17th we worked over the same ground, the wind blowing from the northeast, but gradually moderating. The gill net was hauled, but caught nothing. An orange filefish (*Alutera schœpfii*) was speared. We then looked around east and west along the shore and saw no fish except *Fundulus majalis* and *Menidia notata*. It should be noted, however, that on the same date a pound near Clam Pond Cove furnished us with *Chætodon ocellatus*, *Mullus auratus*, *Elops saurus*, *Caranx crysos*, *Raia ocellata*, *Raia erinacea*, *Alutera schœpfii*, *Mustelus canis* and *Stenotomus chrysops*, while the saurel (*Trachurus trachurus*) was present in Clam Pond Cove on the preceding day.

A large reflector lantern used for 'fire-lighting' eels at night was found useful for the capture of other fishes and for studying their attitudes and movements in the water. On the night of September 16th the lantern was held over the side of our sloop in Clam Pond Cove, and it attracted to us silver gar (*Tylosurus marinus*), killifish (*Fundulus majalis* and *F. heteroclitus*), silverside (*Menidia notata*), half beak (*Hyporhamphus roberti*), annelids (*Nereis sp.*), crabs, shrimp, beetles and moths. By means of a dip net it was easy to take any of the species. On the night of October 13th we were on the south shore of Great South Bay near Horsefoot Creek, spearing eels with the help of the lantern.

We took about twenty pounds of large eels, and nearly all of them were in very shallow water, close to the shore, hiding in the grass or on the sand bottom. One large eel, at the mouth of Horsefoot Creek, was standing on its head, boring for worms when it was speared. The silver gars and silversides played around the light, following it persistently in a semi-dazed fashion. Killifish, toadfish and many crabs were seen resting on the bottom, the toadfish sometimes lying on its side, with its tail curled toward its head. Young bluefish were seen darting out of the way occasionally. Sev-

eral quawks were fascinated by the lantern, and we pushed up close to them before they started off with owl-like motion and discordant cries.

The writer is now able, from personal studies, to report 163 species of fishes in waters extending from Gravesend Bay eastward to Mecox Bay, and refers to his articles published in the Nineteenth Annual Report of the New York Fish Commission (1890) and the Bulletin for 1897 of the American Museum of Natural History, New York City.

The marine fishes now certainly known in the New York fauna represent 200 species. The fresh waters contain 116 species, and there are, besides, 13 anadromous forms. The list might be further increased by the addition of the following fishes concerning whose pertinence to the fauna there is more or less doubt: *Lucius vermiculatus*, *Seriola lalandi*, *Coryphæna equisetis*, *Boleosoma nigrum*, *Polyprion americanus*, *Epinephelus niveatus*, *Dules auriga*, *Zenopsis ocellatus*, *Spheroides trichocephalus*, *Aspidophoroides monopterygius*, *Ulvaria subbifurcata*, *Stichæus punctatus*, *Leptoblennius serpentinus*, *Cryptacanthodes maculatus*, *Anarhichas lupus*, *Trigla cuculus*, *Brosmius brosme*, *Hippoglossoides platessoides*, *Ogcocephalus vespertilio*.*

Thus, a catalogue of the New York fishes, based upon our present knowledge and including the foregoing 19 forms doubtfully assigned to the fauna, will contain 348 species. It should be remembered that no systematic account of the fishes has been published since 1842, and many large regions of the State are almost, or altogether, unknown to the ichthyologist.

TARLETON H. BEAN.

* The bat-fish must be transferred to the list of species known to occur in New York. Dr. Theodore Gill, in the mid-summer of 1854 or 1855, saw a recently-caught example of it at a wharf at the foot of 27th Street, East River, New York. No record of its occurrence was published.

SUPPRESSION OF SMOKE.

THE devising of practicable methods of reduction of the 'smoke nuisance' has become one of the most important problems in applied science for our time, and has been a subject of experiment and of legislation for many years past. Of late, some success has been met with on both sides the Atlantic. In St. Louis, perhaps, as great success has been attained as in any city in the United States, through the public-spirited cooperation of the city government, the Board of Trade and the scientific men and leading engineers of the place; but there remains much to be done and investigations are still in progress, some of which are important. Recent discussions at Philadelphia, under the auspices of the Franklin Institute,* have thrown much light upon the subject and have afforded many valuable facts and data.

We have now the published results of another and formal investigation by a commission, organized at Paris, composed of MM. Huet, Brull, Hirsch, Humblot, Lamouroux, Michel-Levy and DeTavernier, all holding important positions in the municipal administration, or in the great schools of mines and engineering, or as leading members of the Society of Civil Engineers. The commission was in session, at intervals, from June, 1894, to October, 1897. It made a study of reports and documents bearing upon the subject, conducted important experiments, reduced them to order and studied out definite conclusions, and also investigated the origin, state and the progress of the art, completing its report at the last-named date. This document of over 150 pages, large 8vo, with 25 plates, is now in process of distribution.†

Although more or less attention had been

* Journal Franklin Institute, June, 1897.

† "Concours pour la suppression des fumées produites par les foyers de chaudières à vapeur. Rapport de la Commission technique. Prefecture du Depart-

given the subject by the municipal government for years, nothing had been accomplished, and it was, in this instance, proposed to organize a technical commission to conduct competitive tests of various methods and apparatus having for their object the suppression of smoke from boiler-furnaces. The above-named commission was accordingly formed and was assigned a credit of 8,050 francs for expenses. The commission was to select acceptable forms of furnace and report to the city government for their license and use. One hundred and ten competitors appeared, their schemes including the following:

GENERAL PLAN OF PROCEDURE.

(1) Mechanical feed and methodical combustion.	16
(2) Supplementary injection of air, hot or cold..	20
(3) Injection of steam, with or without air.....	5
(4) Stirring the gases.....	7
(5) Gas producers and heating the gases.....	7
(6) Combustion of dust fuel...	2
(7) Washing the smoke	16
(8) Various other systems.....	37
	110

Of the total, three-fourths were French devices, one-fifth English, 3 American, and the others of various European nationalities. A preliminary study led to the careful test of ten. These were tested to ascertain whether they were capable of burning ordinary fuels without smoke and whether they were suitable for use in steam-making.

They were tested with rapid and with slow combustion, with operatives supplied by the makers and with firemen furnished by the commission, under the direction of first the one and then the other. The intensity of the smoke was observed and noted on a scale of five points. The usual standard methods of determining the efficiency of the apparatus were employed. The corps of observation was detailed from the offices of the city administration, organized and directed by the commission.

The history of legislation, as given, traces the progress of the subject in England from the time of Charles II., who, two hundred years ago, inaugurated repressive measures. In France this form of legislation began with an imperial decree in 1810. Both countries now have well-considered laws for suppression of smoke in cities. The technical history, curiously enough, begins with plans by Denis Papin. The next inventor to follow this illustrious man of science was James Watt, with his inverted draught and later arrangement of 'dead-plate.' The 'automatic stokers,' '*très usités en Amérique*,' are referred to and their incidental but none the less effective, smoke reductions are described. Legislation now exists in all civilized countries, and many more or less effective devices and methods are in use for suppression of smoke.

A commission of distinguished engineers and scientific men was organized by the German government, in 1892, which, after prolonged experimental investigation, concluded that success had not been attained, but that the way to success was clearly indicated. This commission, in computing the heating power of combustibles from analyses, adopted the formula: $8000\ C + 29000\ (H - O/8) + 2500\ S - 600\ W$; where W is moisture.

The outcome of the work of the French Commission was the refusal to assign a first prize, the awarding of two second prizes, of two first mentions and of one second mention. The conclusions formulated indicate that the Commission is not satisfied that a real success has been achieved, but nevertheless the researches were not without value. Like the German Commission of 1892–4, it is concluded that "The work of the Commission should be considered only as a contribution to the study of 'fumivorité,' and it is to be hoped that these re-

ment de la Seine, Ville de Paris, République Française—Liberté, Égalité, Fraternité." n. d.

searches may continue. There remains much to be done and a part of this collection of exhibits has very nearly attained the object proposed."

Among the specific conclusions are these:

Smoke cannot be suppressed without considerable excess of cost.

Special fuels, as anthracite, coke, fuel-gas and mineral oils, may be resorted to, and with success, where cost is not objectionable.

The chimney-top should be visible to the man at the furnace.

Prolonged trials should supplement such investigations as those prosecuted by this Commission, to ascertain the durability of the apparatus and of its efficiency.

Existing legislation, well enforced, is advised, rather than any specific new legislation.

The appendix to the report is an elaborate presentation of the logs, tables and drawings of the apparatus of the trials described in the text. The whole constitutes a very valuable contribution to the literature of the subject, in the department of applied science, and deserves to be permanently preserved in every library of applied science, beside the reports of the Franklin Institute discussion.

R. H. THURSTON.

AMERICAN MATHEMATICAL SOCIETY.

THE fifth annual meeting of the American Mathematical Society was held in Fayerweather Hall of Columbia University, on Wednesday, December 28, 1898. On the two following days the Chicago Section of the Society held its fourth regular meeting in the Ryerson Physical Labratory of the University of Chicago. At the election held at the annual meeting the following officers and members of the Council were chosen: President, R. S. Woodward; First Vice-President, E. H. Moore; Second Vice-President, T. S. Fiske; Secretary, F. N. Cole; Treasurer, Harold Jacoby; Librarian, Pomeroy Ladue; Committee of Publication, T. S. Fiske, F. N. Cole, Alexander Ziwet; members of the Council to serve for three years, Maxime Bôcher, James Pierpont, Charlotte Angas Scott.

The Society has now completed its tenth year of continuous existence, having been organized as the New York Mathematical Society in November, 1888, and reorganized under its present title in July, 1894. The *Bulletin* is now in its eighth annual volume; the first number appeared in October, 1891. The present membership of the Society is 315. About ninety papers have been presented at its meetings during the past year. The Chicago Section was organized in April, 1897, and has proved from the beginning a valued addition to the Society's strength.

At the annual meeting the following papers were read:

(1) PROFESSOR M. I. PUPIN: 'On multiple resonance.'

(2) DR. A. S. CHESSIN: 'On the development of the perturbative function in terms of the eccentric anomalies.'

(3) DR. A. S. CHESSIN: 'On some points of the theory of functions.'

(4) PROFESSOR E. O. LOVETT: 'On the transformation of straight lines into spheres.'

(5) DR. E. J. WILCZYNSKI: 'A generalization of Appell's factorial functions.'

(6) PROFESSOR ORMOND STONE: 'On the solution of Delaunay's canonical system of equations.'

(7) DR. VIRGIL SNYDER: 'Asymptotic lines on ruled surfaces having two rectilinear generators.'

(8) DR. G. A. MILLER: 'On a memoir on the substitution groups whose degree is less than nine.'

(9) DR. W. SCHULZ: 'On the partial differential equation

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = ke^u$$

and its connection with Dirichlet's principle.'

The following is a list of the papers read before the Chicago Section:

(1) DR. L. E. DICKSON: 'The determination of the structure of all linear homogeneous groups in a Galois field which possess a quadratic invariant, with the announcement of two new systems of simple groups.'

(2) MR. CARL C. ENGBERG: 'The Cartesian oval and the auxiliary parabola.'

(3) Professor Arthur S. Hathaway: 'A new way of presenting the principles of the calculus.'
(4) Professor H. Maschke: 'Some general theorems concerning linear substitution-groups of finite order.'
(5) Professor E. H. Moore: 'Concerning Klein's groups of n! (n—1)-ary collineations.'
(6) Professor E. H. Moore: 'The decomposition of a modular system connected with the doubly generalized Fermat theorem.'
(7) Professor H. B. Newson: 'Normal forms of projective transformation (second communication).'
(8) Professor H. B. Newson: 'A new solution of the Riemann-Helmholtz problem.'
(9) Professor H. B. Newson: 'What constitutes a continuous group?'
(10) Professor James B. Shaw: 'Some quaternion integrals and their related classes of functions.'
(11) Dr. H. F. Stecker: 'Non-Euclidean images of plane cubics on rotation surfaces of constant negative curvature.'
(12) Professor Henry S. White: 'Note on certain relations among fundamental covariants of a ternary cubic.'
(13) Professor J. W. A. Young: 'The teaching of mathematics in the higher schools of Prussia.'

F. N. Cole,
Secretary.

Columbia University.

GENERAL MEETING OF THE AMERICAN CHEMICAL SOCIETY.

The eighteenth general meeting of the American Chemical Society was held in New York on the 27th and 28th of December, and was in every respect a most successful and notable gathering.

The opening session was held at the rooms of the Chemists' Club, 108 West 55th Street, with an attendance of about one hundred and fifty members and visitors.

Dr. McMurtrie welcomed the visitors and then introduced Mr. Randolph Guggenheimer, President of the Council, who welcomed the Society to the city. Professor Alexander S. Webb, of the College of the City of New York, welcomed the Society to the educational and scientific institutions of the city. President C. E. Munroe responded in behalf of the Society, after which the following papers were read:

'A New Method for the Separation of Arsenic, Antimony, Selenium and Tellurium from one another and from other Metals,' A. E. Knorr; 'Separation of Impurities in the Electrolytic Refining of Copper,' by P. de P. Ricketts; 'The Preparation of Metallic Tellurium,' Victor Lehner.

The meeting was then adjourned to take a special train to the New Jersey Zinc and Iron Company's works at Newark, N. J., where a luncheon was served, and the process of manufacture of zinc oxide was shown. Parties were also made up to visit the Wetherill Concentrator Works, Murphy Varnish Company, Lister's Agricultural Chemical Works and others.

In the evening a business session was held at the club rooms, at which reports were received from standing committees and the retiring President made his address. M. Raoul Pictet gave an interesting discourse on the 'Retardation of Chemical Activities at Low Temperatures.' His subject was illustrated by a lantern projection showing a piece of metallic sodium held on a steel needle and both immersed in hydrochloric acid which had been cooled to the lowest temperature obtainable by means of solidified carbon dioxide. There was no reaction between acid and sodium or the iron until a considerable rise of temperature had taken place.

The second day's session was held at Havemeyer Hall, Columbia University, at which the following papers were read:

'Measurement of Turbidity in Water,' W. P. Mason; 'The Assay of Nux Vomica,' E. R. Squibb; 'The Potato and Cassava Starch Industries in the United States,' H. W. Wiley; 'Notes on the Estimation of Carbohydrates,' Traphagen and Cobleigh; 'The Action of Iodine on the Fatty Amines,' J. F. Norris; 'On the Constitution of Some Canadian Baryto-Celestites, C. W. Volney;

'Laboratory Notes,' A. C. Langmuir; 'Flame Colorations by Bromides and Chlorides of Nickel and Cobalt,' A. S. Cushman; 'Classen's Reaction as an Aid to Determination of Constitution of Terpene Ketones,' M. C. Burt; 'Sixth Annual Report of Committee on Atomic Weight,' F. W. Clarke.

A luncheon was provided by the New York Section, which was served in the Industrial Laboratory, after which visits to various manufacturing establishments and a demonstration of the properties of liquid air at the College of the City of New York occupied the rest of the day, and a dinner at the Waldorf-Astoria in the evening closed the official program of a meeting which had been successful beyond the expectations of the most sanguine of those who had worked for it.

The attendance was not less than one hundred and fifty at any of the sessions, and among them a number of ladies, who also graced the dinner with their presence.

DURAND WOODMAN.
Secretary

SCIENTIFIC BOOKS.

The Collected Mathematical Papers of ARTHUR CAYLEY. 4to. 13 Vols., each $6.25. Supplementary Vol., containing Titles of Papers and Index. New York, Macmillan Co. $2.50.

This republication by the Cambridge University Press of Cayley's papers, in collected form, is the most fitting monument of his splendid fame.

He must ever rank as one of the greatest mathematicians of all time. Cayley exceedingly appreciated this action of the Syndics of the Press, and seven of the large quarto volumes appeared under his own editorship.

As to what these thirteen volumes contain it seems vain to attempt even a summary. They cover the whole range of pure mathematics, algebra, analysis, mathematical astronomy, dynamics, and in particular groups, quadratic forms, quantics, etc., etc.

Though abreast of Sylvester as an analyst, he was, what Sylvester was not, also a geometer. Again and again we find the pure geometric methods of Poncelet and Chasles, though, perhaps, not full assimilation of that greater one than they who has now absorbed them--von Staudt.

Cayley not only made additions to every important subject of pure mathematics, but whole new subjects, now of the most importance, owe their existence to him. It is said that he is actually now the author most frequently quoted in the living world of mathematicians. His name is, perhaps, most closely linked with the word *invariant*, due to his great brother-in-arms, Sylvester.

Boole, in 1841, had shown the invariance of all discriminants and given a method of deducing some other such functions. This paper of Boole's suggested to Cayley the more general question, to find 'all the derivatives of any number of functions which have the property of preserving their form unaltered after any linear transformation of the variables.' His first results, relating to what we now call invariants, he published in 1845. A second set of results, relating to what Sylvester called covariants, he published in 1846. Not until four or five years later did Sylvester take up this matter, but then came such a burst of genius that after his series of publications, in 1851–4, the giant theory of Invariants and Covariants was in the world completely equipped.

The check came when Cayley, in his second Memoir on Quantics, came to the erroneous conclusion that the number of the asyzygetic invariants of binary quantics beyond the sixth order was infinite, 'thereby,' as Sylvester says, 'arresting for many years the progress of the triumphal car which he had played a principal part in setting in motion.'

The passages supposed to prove this are marked '*incorrect*' in the *Collected Mathematical Papers*. But this error was not corrected until 1869 [Crelle, Vol. 69, pp. 323–354] by Gordan in his Memoir [dated 8th June, 1868]: "Beweis dass jede Covariante und Invariante einer binaeren Form eine ganze Function mit numerischen Coefficienten einer endlichen Anzahl solcher Formen ist."

Cayley at once returned to the question, found

the source of his mistake, the unsuspected and so neglected interdependence of certain syzygies, and devoted his Ninth Memoir on Quantics (7th April, 1870) to the correction of his error and a further development of the theory in the light of Gordan's results.

The whole of this primal theory of invariants may now be regarded as a natural and elegant application of Lie's theory of continuous groups. The differential parameters, which in the ordinary theory of binary forms enable us to calculate new invariants from known ones, appear in a simple way as differential invariants of certain linear groups. The Lie theory may be illustrated by a simple example.

Consider the binary quadratic form

$$f \equiv a_0 x^2 + 2a_1 xy + a_2 y^2.$$

Applying to f the linear transformation

$$(1) \qquad x = \alpha x' + \beta y', \qquad y = \gamma x' + \delta y',$$

we obtain the quadratic form

$$f' \equiv a'_0 x'^2 + 2a'_1 x'y' + a'_2 y'^2,$$

where the coefficients are readily found to be

$$(2) \qquad \begin{aligned} a'_0 &= \alpha^2 a_0 + 2\alpha\gamma a_1 + \gamma^2 a_2, \\ a'_1 &= \alpha\beta a_0 + (\alpha\delta + \beta\gamma) a_1 + \gamma\delta a_2, \\ a'_2 &= \beta^2 a_0 + 2\beta\delta a_1 + \delta^2 a_2. \end{aligned}$$

We may easily verify the following identity:

$$a'_0 a'_2 - a'^2_1 = (\alpha\delta - \beta\gamma)^2 (a_0 a_2 - a^2_1).$$

Hence $a_0 a_2 - a^2_1$ is an invariant of the form f. In the group theory it is an invariant of the group of linear homogeneous transformations (2) on the three parameters a_0, a_1, a_2.

The only covariant of f is known to be f itself. In the Lie theory it appears as the *invariant* of a linear homogeneous group on five variables, x, y, a_0, a_1, a_2, the transformations being defined by the equations (2), together with (1) when inverted.

In general, the invariants of a binary form of degree n are defined by a linear homogeneous group on its $n + 1$ coefficients, its covariants by a group on $n + 3$ variables.

As in all problems in continuous groups, the detailed developments are greatly simplified by employing the infinitesimal transformations of the groups concerned.

It is readily proven by the group theory that all invariants and covariants are expressible in terms of a finite number of them.

This result is, however, not equivalent to the algebraic result that all rational integral invariants (including covariants) are expressible rationally and integrally in terms of a finite number of such invariants.

Twenty years ago, in my 'Bibliography of Hyper Space and Non-Euclidean Geometry' (*American Journal of Mathematics*, Vol. I., Nos. 2 and 3, 1878), I cited seven of Cayley's papers written before 1873:

I. Chapters in the Analytical Geometry of (n) Dimensions. *Camb. Math. Jour.*, Vol. IV., 1845, pp. 119–127.

II. Sixth Memoir on Quantics. *Phil. Trans.*, Vol. 149, pp. 61–90 (1859).

III. Note on Lobatchevsky's Imaginary Geometry. *Phil. Mag.* XXIX., pp. 231–233 (1865).

IV. On the rational transformation between two spaces. *Lond. Math. Soc. Proc.* III., pp. 127–180 (1869–71).

V. A Memoir on Abstract Geometry. *Phil. Trans.* CLX., pp. 51–63 (1870).

VI. On the superlines of a quadric surface in five dimensional space. *Quar. Jour.*, Vol. XII., pp. 176–180 (1871–72).

VII. On the Non-Euclidean Geometry. *Clebsch Math. Ann.* V., pp. 630–634 (1872).

Four of these pertain to Hyper-Space, and in that Bibliography I quoted Cayley as to its geometry as follows:

"The science presents itself in two ways—as a legitimate extension of the ordinary *two*- and *three*-dimensional geometries, and as a need in these geometries and in analysis generally. In fact, whenever we are concerned with quantities connected together in any manner, and which are or are considered as variable or determinable, then the nature of the relation between the quantities is frequently rendered more intelligible by regarding them (if only two or three in number) as the coordinates of a point in a plane or in space: for more than three quantities there is, from the greater complexity of the case, the greater need of such a representation; but this can only be obtained by means of the notion of a space of the proper dimensionality; and to use such a representation we require the geometry of such space.

An important instance in plane geometry has

actually presented itself in the question of the determination of the number of curves which satisfy given conditions; the conditions imply relations between the coefficients in the equation of the curve; and for the better understanding of these relations it was expedient to consider the coefficients as the coordinates of a point in a space of the proper dimensionality."

For a dozen years after it was written the Sixth Memoir on Quantics would not have been enumerated in a Bibliography of non-Euclidean geometry, for its author did not see that it gave a generalization which was identifiable with that initiated by Bolyai and Lobachévski, though afterwards, in his address to the British Association, in 1883, he attributes the fundamental idea involved to Riemann, whose paper was written in 1854.

Says Cayley: "In regarding the physical space of our experience as possibly non-Euclidean, Riemann's idea seems to be that of modifying the notion of distance, not that of treating it as a locus in four-dimensional space."

What the Sixth Memoir was meant to do was to base a generalized theory of metrical geometry on a generalized definition of distance.

As Cayley himself says: " * * * the theory in effect is that the metrical properties of a figure are not the properties of the figure considered *per se* apart from everything else, but its properties when considered in connection with another figure, viz., the conic termed the absolute."

The fundamental idea that a metrical property could be looked at as a projective property of an extended system had occurred in the French school of geometers. Thus Laguerre (1853) so expresses an angle. Cayley generalized this French idea, expressing all metrical properties as projective relations to a fundamental configuration.

We may illustrate by tracing how Cayley arrives at his projective definition of distance. Two projective primal figures of the same kind of elements and both on the same bearer are called conjective. When in two conjective primal figures one particular element has the same mate to whichever figure it be regarded as belonging, then every element has this property.

Two conjective figures, such that the elements are mutually paired (coupled), form an involution. If two figures forming an involution have self-correlated elements these are called the double elements of the involution.

An involution has at most two double elements, for were three self-correlated all would be self-correlated. If an involution has two double elements these separate harmonically any two coupled elements. An involution is completely determined by two couples.

From all this it follows that two point-pairs A, B and A_1, B_1 define an involution whose double points D, D_1 are determined as that point-pair which is harmonically related to the two given point-pairs.

Let the pair A, B be fixed and called the Absolute. Two new points A_1, B_1 are said (by definition) to be equidistant from a double point D defined as above. D is said to be the 'center' of the pair A_1, B_1. Inversely, if A_1 and D be given, B_1 is uniquely determined.

Thus, starting from two points P and P_1, we determine P_2 such that P_1 is the center of P and P_2, then determine P_3 so that P_2 is the center of P_1 and P_3, etc.; also in the opposite direction we determine an analogous series of points P_{-1}, P_{-2}, ... We have, therefore, a series of points

$$\ldots, P_{-2}, P_{-1}, P, P_1, P_2, P_3, \ldots.$$

at 'equal intervals of distance.' Taking the points P, P_1 to be indefinitely near to each other, the entire line will be divided into a series of equal infinitesimal elements.

In determining an analytic expression for the distance of two points Cayley introduced the inverse cosine of a certain function of the coordinates, but in the Note which he added in the Collected Papers he recognizes the improvement gained by adopting Klein's assumed definition for the distance of any two points P, Q:

$$\text{dist. } (PQ) = c \log \frac{AP.BQ}{AQ.BP},$$

where A, B are the two fixed points giving the Absolute.

This definition preserves the fundamental relation

$$\text{dist. } (PQ) + \text{dist. } (QR) = \text{dist. } (PR).$$

In this note (Col. Math. Papers, Vol. 2, p.

604) Cayley discusses the question whether the new definitions of distance depend upon that of distance in the ordinary sense, since it is obviously unsatisfactory to use one conception of distance in defining a more general conception of distance.

His earlier view was to regard coordinates 'not as distances or ratios of distances, but as an assumed fundamental notion, not requiring or admitting of explanation.' Later he regarded them as 'mere numerical values, attached arbitrarily to the point, in such wise that for any given point the ratio $x : y$ has a determinate numerical value,' and inversely.

But in 1871 Klein had explicitly recognized this difficulty and indicated its solution. He says: "The cross ratios (the sole fixed elements of projective geometry) naturally must not here be defined, as ordinarily happens, as ratios of sects, since this would assume the knowledge of a measurement. In von Staudt's Beiträgen zur Geometrie der Lage (§ 27. n. 393), however, the necessary materials are given for defining a cross ratio as a pure number. Then from cross ratios we may pass to homogeneous point- and plane-coordinates, which, indeed, are nothing else than the relative values of certain cross ratios, as von Staudt has likewise shown (Beitraege, § 29. n. 411)."

This solution was not satisfactory to Cayley, who did not think the difficulty removed by the observations of von Staudt that the cross ratio (A, B, P, Q) has "independently of any notion of distance the fundamental properties of a numerical magnitude, viz.: any two such ratios have a sum and also a product, such sum and product being each of them a like ratio of four points determinable by purely descriptive constructions."

Consider, for example, the product of the ratios (A, B, P, Q) and $(A,' B,' P,' Q')$. We can construct a point R such that $(A,' B,' P,' Q') = (A, B, Q, R)$. The product of (A, B, P, Q) and (A, B, Q, R) is said to be (A, B, P, R). This last definition of a product of two cross ratios, Cayley remarks, is in effect equivalent to the assumption of the relation dist. (PQ) + dist. (QR) = dist. (PR).

The original importance of this memoir to Cayley lay entirely in its exhibiting metric as a branch of descriptive geometry. That this generalization of distance gave pangeometry was first pointed out by Klein in 1871.

Klein showed that if Cayley's Absolute be real we get Bolyai's system; if it be imaginary we get either spheric or a new system called by Klein single elliptic; if the Absolute be an imaginary point pair we get parabolic geometry; and if, in particular, the point pair be the circular points we get ordinary Euclid.

It is maintained by B. A. W. Russell, in his powerful essay on the Foundations of Geometry (Cambridge, 1897), "that the reduction of metrical to projective properties, even when, as in hyperbolic geometry, the Absolute is real, is only apparent, and has merely a technical validity."

Cayley first gave evidence of acquaintance with non-Euclidean geometry in 1865 in the paper in the *Philosophical Magazine*, above-mentioned.

Though this is six years after the Sixth Memoir, and though another six was to elapse before the two were connected, yet this is, I think, the very first appreciation of Lobachévsky in any mathematical journal.

Baltzer has received deserved honor for in 1866 calling the attention of Hoüel to Lobachévsky's 'Geometrische Untersuchungen,' and from the spring thus opened actually flowed the flood of ever-broadening non-Euclidean research.

But whether or not Cayley's path to these gold-fields was ever followed by any one else, still he had therein marked out a claim for himself a whole year before the others.

In 1872, after the connection with the Sixth Memoir had been set up, Cayley takes up the matter in his paper, in the *Mathematische Annalen*, 'On the Non-Euclidean Geometry,' which begins as follows: "The theory of the non-Euclidean geometry, as developed in Dr. Klein's paper 'Ueber die Nicht-Euclidische Geometrie,' may be illustrated by showing how in such a system we actually measure a distance and an angle, and by establishing the trigonometry of such a system."

I confine myself to the 'hyperbolic' case of plane geometry: viz., the Absolute is here a real conic, which for simplicity I take to be a circle; and I attend to the points *within* the circle.

I use the simple letters, a, A, . . to denote (linear or angular) distances measured in the ordinary manner; and the same letters with a superscript stroke $\bar{a}$, $\bar{A}$, . . to denote the same distances measured according to the theory. The radius of the Absolute is for convenience taken to be $= 1$; the distance of any point from the center can, therefore, be represented as the sine of an angle.

The distance $\overline{BC}$, or say $\bar{a}$, of any two points B, C is by definition as follows:

$$\bar{a} = \tfrac{1}{2} \log \frac{BI \cdot CJ}{BJ \cdot CI}$$

(where I, J are the intersections of the line BC with the circle).

As for the trigonometry "the formulæ are, in fact, similar to those of spherical trigonometry with only cosh $\bar{a}$, sinh $\bar{a}$, etc., instead of cos a, sin a, etc."

Cayley returned again to this matter in his celebrated Presidential Address to the British Association (1883), saying there: "It is well known that Euclid's twelfth axiom, even in Playfair's form of it, has been considered as needing demonstration; and that Lobatschévsky constructed a perfectly consistent theory, wherein this axiom was assumed not to hold good, or say a system of non-Euclidean plane geometry. There is a like system of non-Euclidean solid geometry."

"But suppose the physical space of our experience to be thus only approximately Euclidean space, what is the consequence which follows?"

The very next year this ever-interesting subject recurs in the paper (May 27, 1884) 'On the Non-Euclidean Plane Geometry.' "Thus the geometry of the pseudo-sphere, using the expression straight line to denote a geodesic of the surface, is the Lobatschévskian geometry; or, rather, I would say this in regard to the metrical geometry, or trigonometry, of the surface; for in regard to the descriptive geometry the statement requires some qualification * * * this is not identical with the Lobatschévskian geometry, but corresponds to it in a manner such as that in which the geometry of the surface of the circular cylinder corresponds to that of the plane. I would remark that this realization of the Lobatschévskian geometry sustains the opinion that Euclid's twelfth axiom is undemonstrable."

But here this necessarily brief notice must abruptly stop. Cayley, in addition to his wondrous originality, was assuredly the most learned and erudite of mathematicians. Of him in his science it might be said he knew everything, and he was the very last man who ever will know everything. His was a very gentle, sweet character. Sylvester told me he never saw him angry but once, and that was (both were practicing law!) when a messenger broke in on one of their interviews with a mass of legal documents—new business for Cayley. In an access of disgust, Cayley dashed the documents upon the floor.

GEORGE BRUCE HALSTED.
AUSTIN, TEXAS.

Commercial Organic Analysis. A treatise on the properties, proximate analytical examination, and modes of assaying the various organic chemicals and products employed in the arts, manufactures, medicine, with concise methods for the detection and determination of their impurities, adulterations and products of decomposition. By ALFRED H. ALLEN, F. I. C., F. C. S. Third Edition. Illustrated. With revisions and addenda by the author and HENRY LEFFMANN, M.A., M.D. Philadelphia, P. Blakiston's Son & Co. 1898. Volume I., Introductions, alcohols, neutral alcoholic derivatives, sugars, starch and its isomers, vegetable acids, etc.; pp. xii+557; Price, $4.50. Volume IV., The proteids and albuminous principles; Second Edition; pp. xi+584; Price, $4.50.

The immediate reason for the present publication of the first volume of the third edition of this well-known work has been the appearance of an unauthorized reprint of the second edition. As the second edition was printed in 1885 it is out of date on some points, and many desirable additions and corrections have been made, partly by Mr. Allen, partly by Dr. Leffmann. The plan of the book not only includes careful directions for the analysis of commercial organic substances, and in many cases a discussion of various methods which have been proposed,

but it also gives very many illustrations of actual cases of adulteration, and of difficult problems in analysis which have come under the observation of the author and of others. These features of the work make it almost indispensable for any chemist who has occasion to make analyses in this field. Any one interested in organic chemistry, indeed, will find very many things in the work which are valuable and useful.

In a work of such extent, and especially in one which has grown to its present form during many years under the hands of a busy analyst, it would be impossible that there should not be some things which do not correspond to the best present knowledge. Thus, the same principle which led the author to give Victor Meyer's air-displacement method for the determination of molecular weights should have been the occasion for giving the freezing-point and boiling-point methods, which would be much more generally useful for analytical purposes. On p. 210 arsenic (from the red phosphorus used in its preparation) should have been given as an impurity to be looked for in ethyl bromide. On p. 247 arabinose is incorrectly given as a hexose. On p. 342 'alumina cream' is given as a reagent with a reference to p. 357, but directions for its preparation cannot be found on that page or by means of the index. Some other criticisms of a similar sort might be made, but it would be a thankless task for a reviewer to select, among thousands of statements which are correct and valuable, a few which might be improved.

The fourth volume is the last of the second edition. It discusses the analysis of proteids and albuminous principles. The first portion of the book gives the classification and general analytical reactions of the proteids. Then follow directions for the analytical examination of the proteids of eggs, blood plasma, urine, plants, milk, meat, of digestion (pepsin, peptones, etc.) and of blood. Under the head of proteoïds or albuminoïds, such substances as gelatine, glue, silk, hair and wool are considered. The following statement from the preface is especially significant: "I may here repeat that I am fully conscious that much of the matter of Volume IV. is scarcely such as might be expected to be contained in a work purporting to treat of Commercial Analysis, but I have thought it better to include all facts possessing for me an analytical or practical interest, believing that what I find useful myself will also be of value or interest to others." It is just because Mr. Allen has made these books inclusive rather than exclusive that they prove so useful to the experienced chemist.

W. A. Noyes.

Sewerage: The Designing, Construction and Maintenance of Sewerage Systems. By A. Prescott Folwell. New York, John Wiley & Sons. 1898. 8vo. Pp. x+372. Price, $3.00.

The whole subject of sewerage is naturally divided into three parts: first, the plumbing and drainage of houses; second, the street conduits and their appurtenances; third, the disposal and purification of the sewage. This volume deals with the second part of the subject almost exclusively, only seven pages being devoted to the first and sixteen pages to the third. The facts and discussions are hence mainly from the point of view of the constructing engineer rather than from the sanitary side, and the object is to give directions for building an efficient plant for the removal of sewage from a town and maintaining it in proper repair and cleanliness. This object is accomplished in a very satisfactory manner.

The use of cesspools as a receptacle for the refuse of houses is severely condemned; the author has found the soil of a city street colored black by the liquid from a cesspool 75 feet distant, which must have passed under or around the cellar of a house. The pail systems of removal, used somewhat in France and England, as also the earth-closet system, are regarded as vastly preferable to the cesspool and privy methods which are so generally used in villages, and it is recommended that towns without a water supply should introduce them as a temporary measure. Towns having a good supply of water should introduce a water-carriage system in preference to all other methods on account of its great sanitary advantages.

The two water-carriage systems in common use, called the combined system and the separate system, are described and compared, and

the methods for designing and constructing sewers for each are presented in full detail. The combined system carries both the house sewage and the storm water, while the separate system carries only the former, with a small additional amount of water for flushing. The first system may be the more advantageous when the conditions require an underground system of conduits to dispose of the flood water, and the second may be better when the storm water can be easily carried away through the street gutters. In general, the separate system has been found lower in cost than the combined one for small towns, and hence its extensive use during recent years.

The author's treatment of methods of flushing and cleaning sewers is full and thorough. With respect to ventilation he concludes that chimneys, fans and other devices have been unsuccessful and that no method better than allowing free egress and ingress of air through manholes, street basins and house-roof pipes, has yet been found. Analyses of sewer air have failed to show greater impurity than that in the air of a crowded city street, whether carbon dioxide or number of bacteria be taken as the basis of comparison, and hence no objection except that due to sentiment can be made to this method of ventilation. The methods of cleaning street basins and sewers and of removing obstructions are explained at length; for the small pipe sewers wooden balls called 'pills' are run through with the current, each successive one being greater in size than the preceding; for those larger than one foot in diameter a cylindrical carriage traveling on wheels is employed. The annual cost of cleaning such pipe sewers is said to range from $4 to $15 per mile.

The book is carefully written, well illustrated, and contains many tables for facilitating computations. It is the only American work which deals in detail with the construction of the sewers of both the combined and separate systems. This is the correct plan of treatment, for there is no inherent reason why one is preferable to the other, and the engineer, in each particular case, must determine from the local conditions the most economic and efficient system.

M. M.

Cuba and Porto Rico, with the other Islands of the West Indies: Their Topography, Climate, Flora, Products, Industries, Cities, People, Political Conditions, etc. By ROBERT T. HILL, of the United States Geological Survey. New York, The Century Company. 1898. 8vo. Pp: xxviii + 429. 2 maps. 79 plates.

Although popular in treatment, this book contains much information of value to specialists in geology and anthropology. Based primarily on personal observation during several extended journeys through the West Indies, it is enriched by large acquaintance with the literature of the West Indies covering the centuries since the discovery of the New World and the planting of the first European colony on the Island of Martinique. In his first chapter ('The Geographic Relations of the West Indies') the author emphasizes his own generalization as to the genetic independence of the three great regions of the western hemisphere, North America, Central America with its Antillean extension, and South America; in the next three chapters ('The West Indian Waters,' 'The Classification of the West Indian Islands,' and 'The Great Antilles') the subject is expanded and illustrated by details; while the thirty-sixth chapter ('Geological Features of the West Indies') is the most convenient summary extant of the geologic history, structure and mineral resources of this half-submerged portion of the mid-American continent. Additional facts concerning the geology of the islands are scattered through many of the chapters, with significant details concerning the flora, fauna and climate. In the eleventh chapter ('The People of Cuba'), the eighteenth chapter ('The People of Porto Rico'), the twenty-second chapter ('Cities and People of Jamaica') the description of the Republic of Haiti, and the thirty-seventh chapter ('Race Problems in the West Indies'), as well as in other portions of the book, the population is described in a notably appreciative way, the mythology and industries receiving especial attention. Throughout, the volume gives evidence of careful observation and mature thought, as well as a strong grasp of the scientific and social problems of the region; it gives promise of becoming not merely the most

useful current hand-book on the West Indies, but a contribution of permanent value to the literature of that part of the western hemisphere. It is admirably printed, artistically bound, amply illustrated, satisfactorily indexed, and well arranged for reference, as well as for consecutive reading.

W J M.

The Birds of Indiana. By Amos W. Butler. 22d Report of the Department of Geology and Natural Resources of Indiana. 1897. 8vo. Pp. 515–1187. 5 plates and numerous cuts in the text.

Commissions for the preparation of State Natural History Reports so often fall into incompetent hands that all ornithologists, and particularly those students of birds residing in the State of Indiana, may congratulate themselves that a person so well qualified as Mr. Butler was selected to write the work under consideration.

The matter relating to the birds known to occur in Indiana is preceded by sections on the 'Indiana Bird Law,' the physiography of the State (from Dryer's 'Studies in Indiana Geography'), 'Peculiarities affecting Bird Distribution,' 'Changes in Bird-Life,' 'Destruction of Birds,' 'Zoological Areas' and 'Bird Migration.' There is also a bibliography giving some 212 titles.

This is followed by keys to the orders, families, genera and species, and biographies of the 321 species recorded from Indiana, including descriptions of their plumages, general and local ranges, nests, eggs, times and manner of occurrences and habits. The report, in fact, is a complete ornithology of Indiana.

Mr. Butler has followed the excellent plan of securing the best available material, for the use of which he makes ample acknowledgment. Thus his keys are taken from Ridgway's and Jordan's 'Manuals,' his illustrations from the publications of the U. S. Biological Survey and Coues's 'Key,' while the number of local observers quoted assures us that the work contains all existing and desired information and that it will long remain the standard authority on Indiana birds. We trust, therefore, that a sufficiently large edition has been printed to prevent its early classification with other State lists, which become 'out-of-print' before those who could make the best use of them learn of their existence.

F. M. C.

The Butterfly Book. A Popular Guide to a Knowledge of the Butterflies of North America. By W. J. Holland. New York, Doubleday & McClure Co. 1898. Imp. 8vo. Pp. xx + 382. 48 colored plates. 183 figures in the text. Price, $3.00.

As the secondary title indicates, this work was prepared to meet a popular need. The preface says: "It is essentially popular in its character. Those who seek a more technical treatment must resort to the writings of others." Nevertheless, it will 'have utility also for the scientific student,' since 'the successful development in recent months of the process of reproducing in colors photographic representations of objects has been, to a certain degree, the argument for the publication' of the work. The forty-eight plates have been reproduced by the new process known popularly as 'three-color printing,' and this is its first application so far as we know—certainly on such a scale—to butterflies. It is, however, an unquestionable and surprising success, destined—if the extraordinarily low price at which the book is sold be any guide—to come into very general use. The representation of the colors as well as of the pattern outstrips all that can be done by chromolithography, and has the added value of an accuracy unattainable except at the high cost of the very best workmanship. As the photographic method employed requires the use of a screen, as in so-called 'half-tone' work, there is a certain loss of vividness, but it appears to be even less than is ordinarily the case with half-tones from a photographic print. This may be seen by an examination of the five plates of caterpillars and chrysalids copied from my 'Butterflies of the Eastern United States,' where direct comparison is available. There are, it is true, a few, but very few, unaccountable and generally very slight changes in tint (as in Pl. 2, Fig. 20; Pl. 3, Fig. 18, and Pl. 5, Fig. 3), and occasionally a blurring, or at least a loss of sharpness, due to imperfect registering, but such mishaps would

ordinarily be noticed only by an expert, so that we must welcome this new process as a great boon. How different copies agree we have not tested.

We have spoken thus in detail regarding the plates, not only from our hope regarding this new process, but because of their special value from a scientific point of view; a large number of the figures being, Chancellor Holland states, photographic reproductions from the types of the butterflies described. Strange to say, it is only in a very few instances that the author has specified *which these are*, and so he has lost an easy opportunity of adding greatly to their value.

Not all the North American species are described or figured in the work, the author quailing before the numerous and rather insignificant Hesperidæ, of which but little more than one-half are treated, and omitting many others found in our lists, but either of doubtful specific validity or differing from their allies by distinctions too fine for any but the expert. This is in the interest of the popular audience to which the work appeals. It is, in fact, an iconography of all the forms interesting an amateur, and more. The only really desirable addition would have been to give more figures of the under-surface where this is characteristic, but one should not quarrel with the generosity here displayed; none can possibly complain that he does not get his money's worth, at least.

As to the text of the work, the first fifth of the book is given up to introductory matter on structure, collecting, etc., and the remainder (except a few interspersed essays) to a systematic but very general account of the insects figured, with very many text illustrations, principally of neuration. The different groups are described as well as the species—a desirable feature, but one not altogether common in popular works; and the classification used is more modern than in most of such books. The author's use of genera is not equal, and is 'conservative'—that is, there are many magazine genera here and there, but with a tendency to the discrimination of later times. The descriptions of the species are short—often very short; and attention is paid to the early stages, but almost absolutely none at all to life-histories, which should be one of the principal aims in a popular treatise.

The work will surely command a large sale and prove a great stimulus to the study of butterflies. Certainly we have never before had such a generous aid to those wishing to cover the whole field. Why should the publishers stamp the cover 'The Butter-Fly Book?' The author surely is not responsible for this, for the proofs have been well read. The publishers have, otherwise, done their part well; the topography is clear and careful, and there is a good index.

SAMUEL H. SCUDDER.

BOOKS RECEIVED.

Michael Faraday, his Life and Works. SYLVANUS P. THOMPSON. New York, The Macmillan Co. 1898. Pp. x + 308.

The Elements of Physics. EDWARD L. NICHOLS and WILLIAM S FRANKLIN. Vol. I., Mechanics and Heat. New edition, revised with additions. New York, The Macmillan Co. 1898. Pp. xiii + 219. $1.50.

Principles of Plant Culture. E. S. GOFF. Madison, The Author. 1899. Pp. 287.

SCIENTIFIC JOURNALS AND ARTICLES.

THE *Psychological Review* for January opens with Professor Münsterberg's presidential address before the American Psychological Association, the subject being 'Psychology and History.' This address, together with other articles that Professor Münsterberg has recently published in the *Atlantic Monthly* and elsewhere on the subject-matter of psychology and its relations to other sciences and to philosophy, will shortly be issued in book form by Messrs. Houghton, Mifflin & Co. Professor J. R. Angell and Miss H. B. Thompson contribute from the laboratory of the University of Chicago a study of the relations between certain organic processes and consciousness, elaborately illustrated with tracings of pulse and breathing. Mrs. C. Ladd Franklin publishes her paper on Professor Müller's 'Theory of the Light-sense,' read before the recent meeting of the American Association. There are other articles on 'Theories of Play,' by Mr. H. M. Stanley; on 'Eucken's Struggle for a Spiritual Content of Life,' by Professor Francis Kennedy, and on 'The Effects of Ether.'

THE *Educational Review* for January, which is the first number of the seventeenth volume, opens with an article by Dr. W. T. Harris on the future of the normal school, reviewing 'the five stages' in education. Dr. Harris quotes for edification the anecdotes of Newton and the apple and Cuvier reconstructing an extinct animal from a single bone. Professor Thurston contributes the paper on professional and academic schools read by him at the Association of Colleges and Preparatory Schools of the Middle States and Maryland, and Dr. E. L. Thorndike points out the sentimentality of nature study, which interferes with the teaching of science.

THE Macmillan Company announces the publication, in February, under the editorship of Mr. Frank M. Chapman, of the first number of a popular bi-monthly magazine, addressed to observers rather than to collectors of birds. The contributors will include John Burroughs, Dr. Henry Van Dyke, Bradford Torrey, Olive Thorne Miller, Mabel Osgood Wright, Annie Trumbull Slosson, Florence A. Merriam, J. A. Allen, William Brewster, Henry Nehrling, Ernest Seton Thompson, Otto Widmann and numerous other writers.

A YEARBOOK of Neurology and Psychiatry is announced by S. Karger, Berlin, edited by Drs. Flatau and Jacobsohn, under the direction of Professor Mendel. The work is prepared with the cooperation of a large number of leading German neurologists, and will perform a useful function, owing to the wide dispersion in many journals of publications on the subjects included. It will give not only a bibliography of some thirty-five hundred titles of the literature of 1897, but also short reviews of their contents.

SOCIETIES AND ACADEMIES.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

October 4. MR. LOUIS WOOLMAN, reporting on a specimen of the earth said to be eaten in the South, received through Mr. Wilfred H. Harned from Davidson county, N. C., stated that the substance is not diatomaceous. It had been found, on examination by Mr. S. H. Hamilton, to be composed of twenty per cent. silica and eighty per cent. of kaolin, with a trace of alum.

MR. EDW. GOLDSMITH spoke of the igneous origin of the rocks on the Massachusetts coast. He suggested that they are of the same age as the Pennsylvania traps and may, therefore, furnish evidence of the existence of craters.

October 11. MR. PHILIP P. CALVERT, in connection with the meeting of the Entomological Section, presented a statement on recent study of neuroptera, reviewing the work of the last three years, or since 1895, when a synopsis of the natural history of the dragon-flies was given before the International Congress of Zoology by Dr. De Selys Longchamp, whose work on these insects extends over a period of sixty-seven years. He has described at least one-half of the two thousand recognized species. The important papers published since the date given were reviewed and their scope commented on.

MR. CHARLES S. WELLES described a vast swarm of the larvæ of *Daremma Catalpæ* observed during the summer at Media. The development and distribution of the insect were described and illustrated by specimens.

DR. HENRY SKINNER further commented on the life-history of the species.

MR. WITMER STONE spoke of the distribution and relationship of *Neotoma pennsylvanica* and its separation from the fossil *Neotoma magister*, described by Baird from the caves of Pennsylvania.

October 18. DR. EDW. J. NOLAN presented to the Academy five volumes prepared as a memorial of the late Dr. Joseph Leidy. They consist of a collection of biographical notices, portraits, autograph letters, manuscripts, original drawings of botanical and zoological subjects and notes, the latter having been contributed for the most part by Mrs. Leidy. After describing the contents of the volumes, Dr. Nolan commented on the attainments and personal character of the distinguished naturalist out of loving regard for whom they had been prepared.

MR. JOHN A. SHULZE called attention to specimens of *Isthmia nervosa* from Hudson's Strait. The species was formerly supposed to be confined to the western coast. Its georaphical distribution was further considered by Mr. Lewis Woolman and Mr. Frank J. Keeley.

Mr. N. H. HARNED and DR. J. C. MORRIS spoke of the effect of a plentiful supply of water on the growth of trees.

October 25. DR. DANIEL G. BRINTON made a communication, illustrated by specimens from the Academy's collections, on the ethnography and resources of the Philippine Islands.

PROFESSOR J. WHARTON JAMES, by invitation, spoke of the Enchanted Meza and considered the statements of Professors Libbey and Hodge on the subject. He believed that, while there was evidence of the former presence of man on the Meza, the weight of testimony was entirely opposed to his ever having had permanent places of abode there.

PROFESSOR LIBBEY, who was present, being called on by the President, recounted his experience in exploring the Meza and dwelt on the care with which he had reached his results. He declared that the cairn described by Hodge and Lummis has been built by himself. He agreed with Professor James that the top might have been temporarily occupied, but he was sure it never was a place of residence.

November 1. MR. STEWARDSON BROWN described the results of a recent botanical exploration of the South Mountain region of Somerset County, Pa., a district curiously distinct in its vegetation. The characteristic plants were enumerated.

MR. JOSEPH WILLCOX spoke of the use of fresh-water mussels in the manufacture of pearl buttons.

November 8. MR. H. A. PILSBRY described the physical characters of the Roan Mountain region of North Carolina, and dwelt in detail on the mollusca collected there. Even when the species are widely distributed they are here remarkable as presenting mountain modifications varying from racial characters to those of distinct species. The carinated forms of *Polygyra*, for instance, are extremely characteristic and found nowhere else. The district, in fact, has more peculiar species than any other outside the tropics. He was at a loss to account for this individuality.

MR. ARTHUR ERWIN BROWN called attention to the specific characters of the Ourang, his observations being based on specimens in the Zoological Garden of Philadelphia and the museum of the Academy. He believed in the existence of two well-marked species, the *Simia Satyris* of Linnæus and the *Simia Wurmbii* of Geoffroy St. Hilaire.

November 15. MR. S. D. HOLMAN communicated the life-history of *Pleuromonas* as observed in covered life-slides.

MR. PHILIP P. CALVERT and DR. BENJAMIN SHARP spoke on the subject of cutaneous respiration.

November 22. DR. A. F. WITMER, under the auspices of the Anthropological Section, made a communication on involution and the diseases of senility, dwelling on the atavistic tendency to certain diseases with special reference to forms of neurasthenia and their pathological conditions.

DR. HENRY C. CHAPMAN spoke of the modern theory of the neuron, placing himself on record as believing that it rests on no foundation whatever.

November 29. A symposium was held on the natural history of the Philippines illustrated by specimens from the Academy's collections. Mr. Pilsbry spoke of the distribution and characters of the mollusca; Mr. Witmer Stone of the birds and mammals; Mr. Stewardson Brown of the plants; Dr. Henry Skinner of the lepidoptera, and Mr. P. P. Calvert of the dragon-flies.

Mr. Stone placed on record the recent finding of a small rodent, *Oryzimus palustris*, in New Jersey. It had been discovered in 1816 by Bachman in South Carolina, and the specimen belonging to the Academy, described by Harlan, had been regarded as incorrectly labelled, repeated search having failed to find the form in New Jersey until a week ago, when a number were collected in the southern part of the State by Mr. Henry W. Watrington.

December 6. DR. FLORENCE BASCOM called the attention of the meeting to the determination of rock constituents with special reference to optical methods, the application of polarized light to the work being particularly dwelt on and illustrated.

December 13. DR. J. C. MORRIS presented, in connection with the meeting of the Biological and Microscopical Section, a history of microscopic study and the development of microscopes and microscopic preparations during the last

fifty years, dwelling particularly on the work accomplished by Leidy, Goddard, Neill, Hyrtl and Gibbons Hunt before the recent improvements in methods and instruments were heard of. The communication was illustrated by a large number of instruments and slides and was fully discussed by Messrs. Goldsmith, Keeley, Calvert and Dixon.

Papers under the following titles have recently been presented for publication:

Some Cuban Species of *Cerion*. By H. A. Pilsbry and E. G. Vanatta.

Notes on the Growth of the Hobble-bush, *Viburnum lantanoides*. By Ida A. Keller.

The Occurrence of Marcasite in the Raritan Formation. By S. H. Hamilton.

Margarita Sharpii, a new Alaskan Gastropod. By H. A. Pilsbry.

The Bone-Cave at Port Kennedy, Pennsylvania, and its partial examination in 1894, 1895 and 1896. By Henry C. Mercer.

Observations on the Classification of Birds. By Dr. R. W. Shufeldt.

A Study of the Type Specimens of Birds in the Collection of the Academy, with a brief history of the Collection. By Witmer Stone.

Mr. Mercer's paper will be published in the *Journal* of the Academy, the others in the *Proceedings*.

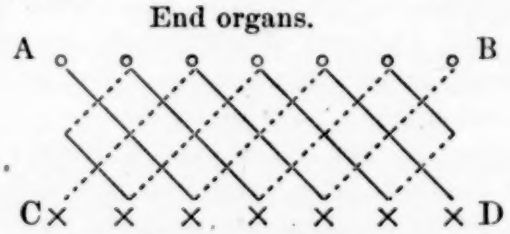
E. J. Nolan,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE SENSATION OF MOTION AND ITS REVERSAL.

To the Editor of Science: The writer has for a number of years noticed, during railway journeys, a very peculiar reversal of sensations of motion received through the eye, of which he has never seen any description or explanation. The following description and explanation may, therefore, interest the readers of Science. A sensation of reversed motion of stationary points in the field of vision is perceived by the writer after gazing fixedly out of a car window at a moving landscape. This sensation is quite intense when the eyes are first turned away from the window, dies away gradually, and is greatly weakened by attentive vision. For example, when looking out of the rear door of the train the various objects in the visual field appear to move towards the center of the field, and upon turning the eyes upon an object in the car everything seems to move away from the center of the visual field; if the train comes to a quick stop while the eyes gaze steadily out at a window the motion of the landscape and the inferred motion of the train appears to be momentarily reversed at stopping, etc.

The existence of this sensation of motion of stationary objects seems to indicate that neither the succession of stimuli nor the stimulation of successive nerve elements is the fundamental fact in the sensation of motion, but rather that the sensation of motion, like other specific sensations, depends upon a *state* of nervous commotion, a state which has, of course, resulted from and is the integral effect of a succession of stimuli. A concrete notion of the character of this state of nervous commotion is as follows:



Let the dots A B represent the end organs of sight—rods and cones—and the crosses C D the nerve cells of the central organ. We may imagine each end organ to be connected, either directly or through ganglion cells, with a number of the cells of the central organ. Let us consider the connections indicated by the diagonal full lines and dotted lines. A succession of stimuli of the end organs from A to B and a succession from B to A would result in radically different states of nervous commotion, especially if the cross connections are not entirely symmetrical or if the connecting nerve fibers are loaded with ganglion cells. Also during a succession of stimuli from A to B the fibers represented by the full lines might be fatigued, while the ones indicated by the dotted lines might be saved by inhibition due to the (outgoing) commotion to which they are subjected in advance of the moving stimulus, so that the effects of this moving stimulus reach

the central organs mainly through the full-line connections. A simultaneous stimulus of all the end organ from A to B would then reach the central organ mainly through the dotted connections just as would a stimulus moving from B to A.

W. S. FRANKLIN.

OCCURRENCE OF THE VIRGINIA OPOSSUM IN SOUTHERN CENTRAL NEW YORK.

DURING the present year several Virginia opossums (*Didelphis virginiana*) have been killed near Owego, Tioga Co., N.Y. Some twelve years ago a farmer residing near here told me he had killed one. Last fall a large female was killed on a mountain side two miles east of this village, and while myself hunting a mile farther east, on December 3d, I met a hunter who had just caught two. He had tracked them a mile or so through the snow, and finally dug them out of a woodchuck's hole. They were both dead when found, probably having starved, as their stomachs were empty. Their skulls are in my possession. Several days later he secured another, an old one, the sex I do not know. It was taken four miles west of where the two young ones were captured. The animal is alive and in his possession. This man is an old-time hunter and trapper, and considered truthful. He told me he had seen their tracks several times before. I have failed to learn of anyone who has liberated a pair of these animals or even had a pair in captivity. The capture of two, early in the fall, has come to me, but I cannot say if it is authentic.

I wish particularly to note that this record comes from Owego, N. Y., not Oswego, two widely separated places.

J. ALDEN LORING.

OWEGO, N. Y.

NOTES ON INORGANIC CHEMISTRY.

THE December number of the *Journal of the American Chemical Society* contains an extended review of the year's progress in applied chemistry by Dr. Wm. McMurtrie. Development along these lines is going on more rapidly than ever before, and it is encouraging to note that this country is taking its place as an important factor in chemical technology. While Germany will long hold the first place in those industries in which chemistry plays an important part, America has already become an important factor, especially in the field of electro-chemistry, and it requires little effort of the imagination to see, in the not-far-distant future, the supremacy crossing the water. Dr. McMurtrie's review is well worth careful perusal by the economist as well as the chemist. Only a few points can be noticed in this column. In Germany, at the close of 1896, 96 chemical works, with $64,000,000 capital, gave a return of nearly $8,000,000, an average of 12.3% as against 8.9% for 1897. Of these the coal tar industries gave the highest returns, 24%, while the fertilizer industries gave the lowest. An interesting announcement has been made by Dupre that gold can be extracted from ores by an inexpensive solution containing sodium thiosulfate, ferric halids, with an acetate. The solution extracts fifteen to twenty times as much gold as a cyanid solution in the same time, and does not attack sulfids; hence, if the success of the process is confirmed, it may be expected to replace the cyanid and chlorination processes for low grade and sulfid ores. Great progress has been made in the metallurgy of zinc, and there is every reason to believe that within a few years the old and unsatisfactory process will be entirely displaced, except for very pure ores. The use of the electric furnace is revolutionizing the preparation of phosphorus, and with the increased production in France and Russia, and prospective developments in Germany and at Niagara Falls, the English monopoly is seriously threatened. The advantages of the new processes are both the reduction of price and the increased protection of the health of the operatives. The electrolytic alkali industry is still in an experimental stage, but with the certainty of future success, indeed, it may be said that the great question to-day is the selection and development of the *best* electrolytic method. Already in the manufacture of potassium chlorate the electrolytic methods have taken the lead, with a consequent marked fall in price. The commercial production of liquid air and of oxygen on a large scale will render possible many new developments along many lines. The production of calcium carbid

and acetylene continues to attract much attention. Ten French factories are now making calcium carbid and four more are being built, and it is said two French villages are lighted wholly by acetylene gas, at a cost of 50 per cent. less than coal gas. On the other hand, Welsbach is making improvements in his burner, and Nernst gives hope of a yet more brilliant and economical source of light, as has already been described in the columns of SCIENCE. In conclusion, Dr. McMurtrie says: "In every direction industrial progress is suggestive, and we may expect advancement in all directions with increasing intensity. Commercial artificial indigo, commercial artificial silk, commercial mercerized cotton in its various forms, the new colors and medicinal substances from carbon compounds, new concentrated nutritive substances, synthetic albumen, the various toxins and extracts of animal matters of therapeutic value, all claim a large share of attention; and so do hundreds of other substances and processes in which the principles of chemistry find application to human needs."

IN the Italian *Gazetta* Rebuffat contributes an exhaustive study of hydraulic cements. These he divides into two classes: (1) amorphous, compact cements, which consist of lime, calcium orthosilicate and calcium aluminate, in which, however, the free lime may be wanting; this class contains the hydraulic limes and quick settling cements. (2) Crystalline cements, consisting of a crystalline compound of calcium orthosilicate and lime, with a varying quantity of calcium aluminate; this class contains Portland cements and those rich in silica. After hardening, however, all these cements have the same qualitative composition, consisting of a mixture of calcium hydrate, hydrated calcium silicate of the formula $2(SiO_2, 2CaO), H_2O$, and hydrated calcium aluminate, with a small amount of inert matter. In cements rich in silica a small amount of a double silicate of calcium and aluminum is present, which accounts for the resistance of these cements to sea water. The hardening of cements is chiefly due to the hydrating of the calcium silicate, and to a lesser degree to the hydrating of the calcium aluminate.

IN a recent English patent Weil and Levy claim to electroplate aluminum in baths to which various organic substances are added. Thus for the deposition of silver, hydroquinol is added to an ammoniacal cyanid solution; for copper, ammonium gallate or pyrogallate is used; for nickel, milk sugar, and the same for gold.

J. L. H.

CURRENT NOTES ON METEOROLOGY.

CLIMATE AND HYGIENE OF THE CONGO FREE STATE.

AN important volume on the climate, soil and hygiene of the Congo Free State has been issued as the second part of the Proceedings of the *Congrès National d'Hygiène et de Climatologie Médicale de la Belgique et du Congo*, held in Brussels, August 9–14, 1897. The investigation, of which the results are embodied in this report, was undertaken by a commission of the *Société royale de Médicine publique et de Topographie médicale de Belgique*. On this commission meteorology was represented by M. Lancaster, Director of the Meteorological Service of Belgium, which is equivalent to saying that whatever concerns meteorology and climatology in this report is admirably done. As a whole, this volume gives us the most complete and most scientific account of the meteorology and medical climatology of this interesting district that has yet appeared. The first chapter, of 404 pages, is devoted to the meteorology, and presents a careful summary of what is known concerning the atmospheric conditions and phenomena of the region, including many tables and diagrams. This portion of Africa is one of great interest to meteorologists on account of the seasonal migration of the belt of equatorial rains, and the data concerning the rainfall at Vivi and other stations are, therefore, especially welcome. Chapter II., of twenty pages, is devoted to the geology and soil conditions. Over 400 pages are concerned with the medical climatology and hygiene of the region in general and of the different stations in particular. This last chapter is an extremely valuable one. Of especial interest at the present time is the evidence afforded (p. 464–5) by the result of European colonization in the Congo Free State

that, contrary to the general rule, northern Europeans have succeeded there better than southern Europeans. Italian laborers on the railroad are reported as having suffered more from the climate than many Scandinavians employed on the river. It must be remembered, however, that, of the two occupations, railroad construction and steamboat service, the latter is usually far more healthy, especially in a tropical climate, and a higher disease and death rate are naturally to be expected among persons engaged in the former occupation.

A NEW MOUNTAIN ANEROID BAROMETER.

WHYMPER, in the London *Times* of December 17, 1898, describes a new mountain aneroid which gives results of astonishing accuracy. The ordinary aneroid is well known as being a very inaccurate instrument at high altitudes. In Appendix C ('Comparisons of the Aneroid against the Mercurial Barometer'), in his 'Travels amongst the Great Andes of the Equator,' Whymper himself says that "with aneroids of the present construction it is unlikely that decent approximations to the truth will be obtained at low pressures, even when employing a large number of instruments." The errors in Whymper's whole series of observations amounted in the worst cases to as much as two inches, as compared with the mercurial barometer. The new barometer is the invention of Col. H. Watkin, C.B., Chief Inspector of Position-Finding in the (British) War Department. It is so constructed that it can be thrown out of action when not in use, and put in action when required. When out of action no variations in atmospheric pressure, however large, produce any effect on it. This adjustment is effected by having the lower portion of the vacuum box so arranged that it can rise, instead of having it fixed, as is usually the case. A screw arrangement is attached to the lower portion of the vacuum chamber, and under ordinary conditions this screw is released and the chamber put out of strain. When a reading is to be made, the screw is turned as far as it will go, thus bringing the instrument into the normal condition in which it was graduated. Whymper has made a large number of readings with the new aneroid and finds the error, in the mean of 65 observations, below ± 0.0 in. He feels confident that, "in the hand of those who will give the requisite attention, extraordinary results may be obtained from Watkin's Mountain Aneroid in observations made for altitude and in determining differences of level." The instrument is made by J. J. Hicks, 8 Hatton Garden, London.

R. DEC. WARD.

HARVARD UNIVERSITY.

ZOOLOGICAL NOTES.

THE NEW YORK ZOOLOGICAL PARK.

BULLETIN 3 of the New York Zoological Society bears testimony to the rapid progress that has been made since July 1, 1898, as may be seen by the following statement of work completed up to December 1, 1898. The Elk House has been practically finished. The Bird House is ready to receive its roof. The foundation walls of the Reptile House have been completed, and the steel floor-beams put in place. All excavating for the first series of Bear Dens has been completed, also all plumbing for drainage and water-supply. The brick walls of the bathing-pools have been built, and stone walls to carry the iron work. The excavation of ponds for the Ducks' Aviary and the construction of three islands have been completed. On the south island twelve enclosures have been laid out, with suitable shelter-houses, and about one hundred native shrubs have been planted. A stone wall, going down to bed rock, has been constructed around the Prairie Dogs' Knoll (eighty feet in diameter), and capped with cut stone. Excavations have been made for the walls and stone work of eight Wolf and Fox Dens, and the walls have been laid ready for the cage work. One sleeping den for wolves has been constructed. About five hundred cubic yards of sandy earth has been hauled to the Pheasant's Aviary, to make dry ground for the runways. This was removed by necessity from the Bear Dens, at no cost to the Aviary. The excavation for the Beaver Pond has been completed, and all the grading necessary thereto. The excavation necessary for the Buffalo House has been made. A trench nine hundred and sixty-three feet in length, has been dug for the stone walls to

support the iron fence for the Beaver Pond. The Society is in urgent need of an antelope house and a monkey house, and it is hoped that these will come as gifts from individuals, as the provision hitherto made is for the accommodation of American quadrupeds and birds, and this will exhaust the $106,000 at the disposal of the Society.

The most elaborate of the structures commenced is, by all odds, the Reptile House; this will have a length of 146 feet and a width of 100. It is being constructed of buff mottled brick, combined with granite and terra-cotta. It will be roofed with slate, heated by hot water, and its cost, with cages, will be about $40,000. It is beautifully situated on the edge of a forest of great oaks, very near the geographical center of the park. Close to the southeastern corner of the building is a natural pool in a wide outcrop of granite rock, which will speedily be converted into a summer home for saurians.

It is hoped that the Reptile House can be completed by April, 1899, in time to receive its cages and collections for the opening of the park in May.

The Director has found it necessary to give a chapter 'concerning the purchase of wild animals,' which deserves to be widely read, since with the proper changes it may be made to apply to collectors in various branches of history. The gist of it is contained in the following paragraphs:

"Not unfrequently it happens that a hunter who captures an animal that to him is strange imagines that it is worth double its real value, and feels indignant when a zoological garden offers him what is really a fair price. In about nineteen cases out of every twenty the man who captures a wild animal thinks it is worth far more than it really is. For example, if we were to offer a farmer's boy $2.50 for a wild goose that he had caught and cooped, the chances are he would be highly indignant; but at this moment we know of thirty-two wild geese for sale, property crated, at that price.

If we were asked to name the greatest small annoyance that comes in the daily mail of a zoological park we would reply: The letters which say, "What will you give me for it?" Very often not the slightest clue is given to the size, age, sex or condition of the captive animal. All these are left to be divined by the man who is asked to submit an offer."

F. A. L.

THE STATISTICAL METHOD IN ZOOLOGY.

THE statistical method of biographical investigation has recently been used by Walter Garstang, the naturalist in charge of the fishery investigation of the Plymouth Laboratory, with great success. He claims that it is possible to identify the different schools of fish which approach the shore, even when these schools are made up of individuals which appear to be quite alike. He shows that the mackerel of the American coast are really different from the animals of the same name found along the European coast, and he further shows that the mackerel which frequent the shores of the British Isles may be sub-divided into two principal races, an Irish race and a race frequenting the English Channel and the North Sea. It thus seems that a species heretofore supposed to be widely distributed and given to migrating over long distances of the ocean is really cut up into a number of races, which probably do not intermingle and which may have very limited ranges. If it can be proved—and it now appears to be proved—that the local representatives of each species of animals are branded with indices of consanguinity, which indices may be detected through the plotting of curves of frequency, a new and most fascinating line of investigation is opened to the zoologist, the comparative anatomist and the student of geographical distribution.

H. C. B.

BOTANICAL NOTES.

A BOTANICAL ALMANAC.

A HANDY little book, bearing the title of 'Deutscher Botaniker-Kalender für 1899,' has been prepared by Paul Sydow, of Berlin. It is modeled after the well-known 'Chemiker Kalender' of Dr. Biedermann, which for twenty years has been well-nigh indispensable to the chemists and physicists. This botanical almanac includes a diary (in which notable events, as the births and deaths of great botanists, are recorded), a money table, tables of weights and

measures, the 'Berlin Rules,' catalogue of exsiccati, catalogues of botanic gardens, botanical museums, botanical collections and places where deposited. The publishers (Borntraeger, Berlin) have done their part well, both in printing and binding. The light-colored linen cover and its conventionalized water-lily ornamentation are in most excellent taste.

CHECK LIST OF FOREST TREES.

A VERY convenient, revised and condensed edition of Sudworth's 'Arborescent Flora of the United States' has recently been issued by the Division of Forestry, under the title 'Check List of the Forest Trees of the United States.' It makes use of the modern nomenclature, gives lists of common names, and includes notes as to the range of each species. The following corrections should be made in a later edition:

Pinus ponderosa scopulorum Engelm., add in Nebraska eastward along the Niobrara River to the 99th meridian, and to the 103d meridian on the North Platte and Lodge Pole Rivers.

Hicoria ovata (Mill.) Britt., change to southeastern instead of northeastern Nebraska.

Hicoria laciniosa (Michx. f.) Sarg., add southeastern Nebraska.

Hicoria alba (Linn.) Britt., add southeastern Nebraska.

Populus tremuloides Michx., change from southern to western Nebraska.

Quercus velutina Lam., add southeastern Nebraska.

Asimina triloba (Linn.) Dunal., add southeastern Nebraska.

Pyrus coronaria Linn. This species is recorded in local catalogues as occurring in eastern Nebraska, but it is *P. ioensis* (Wood) Bailey, if this is to be regarded as a distinct species.

Prunus demissa (Nutt.) Walp., add from central Nebraska westward.

Cercis canadensis Linn., add southeastern Nebraska.

Rhus copallina Linn., add southeastern Nebraska.

Acer saccharum Marsh., strike out eastern Nebraska, as this species does not occur in this region in the wild state, although freely planted.

Acer rubrum Linn., strike out eastern Nebraska, as this species does not occur in this region in the wild state, nor is it often planted.

Æsculus glabra Willd., add southeastern Nebraska.

This check list will render a good service not only to botany, but still more to forestry and horticulture, in giving currency to the revised nomenclature of our forest trees.

CRETACEOUS AND TERTIARY PLANTS.

F. H. KNOWLTON, phytopaleontologist of the United States Geological Survey, publishes, in Bulletin 152 of the Department of the Interior, a most valuable catalogue of the Cretaceous and Tertiary plants of North America. In Lesquereux's catalogue of twenty years ago but seven hundred and six species were included, of which one hundred and fifty seven are from the Cretaceous, and five hundred and forty-nine from the Tertiary. In the list before us about twenty-five hundred species are included. The list is strictly alphabetical and is not divided so as to enable one to easily estimate the number from each period. The date and place of publication of each genus and species are given with much care. The modern nomenclature is used, even to trinomials and the double citation of authors. Much attention is given to synonymy, and to the citation of the more important references, especially to such as include descriptions and figures.

LEWIS AND CLARK'S PLANTS.

THOMAS MEEHAN was fortunate enough to discover, some time ago, in the custody of the American Philosophical Society, some packages of dried plants which, on examination, turn out to be the long-lost collection made by Lewis and Clark, in 1803 to 1806, during their expedition across the Western country from St. Louis to the mouth of the Columbia River. They were examined by Dr. B. L. Robinson and J. M. Greenman, of the Herbarium of Harvard University, and compared with Pursh's treatment of this collection, in his *Flora Americæ Septentrionalis* in 1814, and the results have been published in the Proceedings of the Academy of Sciences of Philadelphia (January, 1898). Mr. Meehan notes that 'this collection contains all but sixteen of Lewis's plants as described by Pursh in his Flora,' and of the missing numbers seven are represented in the herbarium of the Academy by authentic specimens from Lambert's herbarium. Mr. Meehan says further that 'only a few of these seven missing ones are of material importance,' and that 'for all practical purposes all the plants of Lewis and Clark's expedition are now deposited in the Academy.'

CHARLES E. BESSEY.

THE UNIVERSITY OF NEBRASKA.

CURRENT NOTES ON ANTHROPOLOGY.

ARROW FEATHERING IN SOUTH AMERICA.

An excellent study of this subject by Herman Meyer has been translated and published in the Smithsonian Report for 1896 (just issued). Different methods of feathering, seven in number, are shown to have prevailed among the native tribes, each occupying its own area and generally embracing tribes of contrasted affinities in other respects. A map is added indicating these areas. The explanation of this is that many tribes first learned the use of the bow from their neighbors, but that there were as many centers of its invention as there were modes of feathering. At least, this is the simplest explanation, and it is one supported by language, as we find, in the Catoquina, for instance, the words for bow and arrow are both Tupi, and their people have the Tupi plan of feathering. The paper is valuable for other suggestions on native culture.

A STUDY OF THE LIPS.

We are all familiar with the teaching of the physiognomists that thick lips indicate a sensual disposition, and delicate, finely formed lips coincide with a certain spirituality, firmness and elevation of character. Dr. A. Bloch, in a thorough study of the lips from an anthropological point of view, believes that all such indications are imaginary. The form, size and color of these organs belong to race distinctions quite as much as the shape and dimensions of the nose. In fact, they are often in correlation. The pigmentation is notably different in the various sub-species of man, varying from a delicate rose to a dark brown. In hybridity, like many other traits, the lips of one or the other parent may reappear in full character in the child. Really thick lips never occur, except as an anomaly, in the white race. (*Bull. Soc. Anthropologie de Paris*, 1898; Fasc. 3.)

PHYSIOLOGY OF CRIMINALS.

An eminent criminal lawyer once told me that the criminals, as a rule, were better looking men than the 'gentlemen of the jury.' The assertion seemed jocose, but now comes the proof of it. Dr. J. Marty, a French criminologist, reports his examination of 4,000 delinquents in the French army. His results are curious. In height, in weight, in breast measure, in muscular power and in general condition these rascals averaged decidedly better than the well-behaved soldiers of the army!

But Dr. Marty is ready with an ingenious suggestion. Not that criminals are 'by nature' a finer lot physically than non-criminals, but the condition of criminal families is so much more wretched than respectable ones that only the uncommonly strong survive! Ingenious, but not quite satisfying. (*Centralblatt für Anthropologie*, Heft. 4.)

D. G. Brinton.
University of Pennsylvania.

SCIENTIFIC NOTES AND NEWS.

ENDOWMENT OF THE JENNER INSTITUTE.

We announced in a recent issue a gift by Lord Iveagh of £250,000 for the endowment of the Jenner Institute of Preventive Medicine. Further details of this important gift are given by Lord Lister, Chairman of the Council, and Sir Henry E. Roscoe, Treasurer, in the following letter to the press:

We ask permission to announce in your columns a splendid offer in aid of scientific research which has been placed in our hands.

British and Irish men of science have long deplored the fact that the opportunities in this country for research directed to the prevention of disease are not equal to those possessed by foreign nations.

Lord Iveagh wishes to help in removing this reproach to our country, and, on the conditions named below, has offered the sum of £250,000 (two hundred and fifty thousand pounds) for the purposes of the highest research in bacteriology and other forms of biology as bearing upon the causes, nature, prevention and treatment of disease.

He has proposed to the Council of the Jenner Institute (lately the British Institute) of Preventive Medicine—a body which includes leading men in medicine and allied sciences in the British Isles—that the donation shall be handed over to the Institute on condition that in future the control and management of the affairs of the Institute shall be placed in the hands of a new board of seven trustees—three of the seven to be chosen by the Council of the Institute, three by the donor, and one by the Council of the Royal Society.

The offer has been cordially accepted at a meeting of the Council.

The donor further proposes that part of the new fund shall be appropriated to the enlargement of the buildings of the Institute at Chelsea, part to increasing the at present sadly inadequate salaries of the Director and other members of the scientific staff, part to the expenses of administration and maintenance, and the remainder chiefly to founding valuable fellowships and studentships, tenable for limited periods, for research either in the laboratories of the Institute or in centers of outbreaks of disease, whether at home or abroad.

The conditions on which these fellowships and studentships may be held are not yet determined upon, but it is hoped to open them to all classes of her Majesty's subjects.

Lord Iveagh, in our opinion, deserves the gratitude of the nation for thus munificently providing for the cultivation, in the British dominions, of biology and allied sciences for the good of mankind in an institution which henceforth will compare favorably with any similar establishment in other parts of the world.

It will be remembered that the British Institute of Preventive Medicine received from the Jenner Memorial Committee the funds that it had collected and altered its name in honor of Jenner. It has recently taken possession of new buildings on the Chelsea Embankment. Dr. Allan Macfadyen is the Director.

Lord Iveagh has at the same time undertaken to rebuild the most unhygienic district of Dublin, erecting upon it model workmen's dwellings, recreation halls, etc. The cost of the improvements are estimated at over £250,000.

GENERAL.

PROFESSOR B. K. EMERSON, of Amherst College, has been elected President of the American Geological Society in succession to Professor J. J. Stevenson, whose address on 'Our Society' is published in the present number of SCIENCE.

THE American Society of Naturalists at its recent meeting appropriated $50 towards the support of the American University Table at Naples, and $50 towards the support of the Naturalists' Table at the Marine Biological Laboratory at Woods Holl. It was voted that the place of the next meeting be left with the Secretaries of the several societies, who will probably select New Haven. The following is a full list of the officers for the ensuing year: President, W. G. Farlow; Vice-Presideuts, H. C. Bumpus, W. H. Howell, F. H. Gerrish; Secretary, T. H. Morgan; Treasurer, John B. Smith; Members of the Executive Committee elected from the Society-at-large, Bashford Dean, F. H. Herrick.

AT the annual public meeting of the Paris Academy of Sciences, on December 19th, the Permanent Secretary, M. Berthelot, read a memorial notice of Brown-Sequard, the eminent physiologist, who, it will be remembered, was the son of a citizen of Philadelphia. Brown-Sequard led a life full of vicissitudes, crossing the Atlantic more than sixty times, until in 1878 he was elected Professor in the University of Paris and was naturalized as a citizen of France. The President of the Academy, M. Wolf, called attention to the approaching bicentennial of the Academy and paid tributes to the members who had died during the year: MM. Aimé Girard, Souillard, Pomel and Cohn, of Breslau.

AT the same meeting of the Academy the prizes for the current year were awarded. Three of these, as we have already announced, were given to Americans—the Lalande prize to Dr. Seth C. Chandler, the Damoiseau prize to Dr. George W. Hill and the Henry Wilde prize to Mr. Charles A. Schott. Another prize, the Lallemand prize, was divided, and one half given to Mr. Edward P. Allis, of Milwaukee, Wis., for his memoir on 'The cranial muscles and cranial first spinal nerves of *Amia calva*.' In addition to these four prizes coming to America, apparently only two other prizes were given outside of France—the Janssen medal to A. Belopolsky, of the Observatory at Pulkova, for his contributions to astronomy, and the Desmazière prize to Professor de Toni, of Padua, for his *Sylloge Algarum*.

THE Academy offered in all about fifty prizes, the largest of these, the Brêant prize, of 100,000 fr., was in part given to M. Phisalux for his researches on chemical vaccines. The LeConte prize, of 50,000 fr., for an important scientific discovery, was not awarded. The grand mathematical prize (6,000 fr.) was awarded to M. Morel, and the Poncelet prize (2,000 fr.), also in mathematics, to M. Hadam. The Jecker prize in organic chemistry (10,000 fr.) was di-

vided among MM. Bertrand, Buisine and D. Berthelot. The Vaillant prize in geology (4,000 fr.) was given to M. Cayeux, and the Estrade-Delcros prize (8,000 fr.) to M. Munier Chalmas for his work on paleontology and geology.

Professor William Ramsay gave an address before the German Chemical Society, Berlin, on December 20th, describing the newly discovered gases and their relation to the periodic law. He also gave a popular lecture on the subject.

Mr. Sydney Rowland has been appointed Assistant Bacteriologist at the Jenner Institute of Preventive Medicine.

M. Troost has received an anonymous gift of 4,000 fr. for researches on the liquefaction of air.

The Honorable R. J. Strutt, who, as we recorded last week, has been awarded the Coutts-Trotter Studentship in Science at Trinity College, Cambridge, is a son of Lord Rayleigh, the eminent physicist, formerly professor at Cambridge University.

Dr. Alfred A. Kanthack, professor of pathology in the University of Cambridge and Fellow of King's College, died at Cambridge, on December 21st, at the early age of thirty-five years. Dr. Kanthack was elected to the professorship in Cambridge a little more than a year ago, succeeding the late Professor Roy. He is the author of a 'Manual of Morbid Anatomy' and of a 'Hand-book of Bacteriology' and of numerous and important original contributions to these sciences.

We regret also to record the death at Philadelphia, on January 5th, of Dr. E. Otis Kendall, in his eighty-first year. He had been for more than fifty years professor of mathematics in the University of Pennsylvania, though recently he had relinquished active duties. He had also held the chair of astronomy in the University, was long dean of the scientific department, and was in 1883 elected vice-provost, being honorary vice-provost at the time of his death. Dr. Kendall was for twenty-eight years one of the Secretaries of the American Philosophical Society, and for the following twenty-one years one of its Vice-Presidents. He was the author of a text-book of astronomy and of various contributions to mathematics, as well as of computations for the U. S. Nautical Almanac and the U. S. Coast and Geodetic Survey. Dr. Kendall will, however, be best remembered as a teacher, being greatly honored and beloved by many generations of college students.

The death is also announced, at the age of sixty-four years, of Professor H. W. Vogel, of the Institute of Technology at Berlin, known for his researches in photography and spectroscopy.

Ground for the Horticultural Hall of the New York Botanical Gardens was broken on January 3d. The building will be 512 feet long, 60 feet wide, with a dome 90 feet high.

The following lectures will be given during the present season at the American Museum of Natural History at three o'clock on Saturday afternoon.

Jan. 7.—An Exploration for Dinosaurs in the Rocky Mountain Plateau Region..Dr. J. L. Wortman.

Jan. 14.—A Hunt for Fossil Camels and Horses in Kansas and Colorado.....Dr. W. D. Matthew.

Jan. 21.—The Bird Rocks of the Gulf of St. Lawrence..... .....Mr. Frank M. Chapman.

Jan. 28.—Exploration of Zapotecan Tombs of Southern Mexico.....Mr. M. H. Saville.

Feb. 4.—The Jesup North Pacific Expedition: Archæological Exploration in British Columbia, Mr. Harlan I. Smith.

Feb. 11.—The Jesup North Pacific Expedition: The Indian Tribes of the State of Washington, Dr. L. Farrand.

Feb. 18.—Rocks of the State of New York as illustrated in the Museum.....Mr. L. P. Gratacap.

Feb. 25.—A Collecting Trip in Europe, Dr. E. O. Hovey.

Mar. 4.—The Squirrels of North America, Dr. J. A. Allen.

Mar. 11.—The Life Histories of Butterflies and Moths of the Vicinity of New York, Mr. Wm. Beutenmüller.

Mar. 18.—The Hyde Expedition: Exploration of the Ruins of the Pueblo of Bonito, New Mexico, Mr. George H. Pepper.

Mar. 25.—Peoples of Asia—The Philippines to Japan, Professor Albert S. Bickmore.

On Thursday evening at eight o'clock lectures will be given as follows:

The New York Zoological Society.

Jan. 12.—The Zoological Parks of Europe and The New Zoological Park of New York City Professor Henry Fairfield Osborn.

Linnæan Society of New York City.

Jan. 19.—A Naturalist in Florida
FRANK M. CHAPMAN.

Jan. 26.—A Naturalist in Labrador
DR. ROBERT T. MORRIS.

Feb. 2.—A Naturalist on the Pacific Coast
DR. BASHFORD DEAN.

Feb. 9.—A Naturalist in Wyoming
ERNEST SETON THOMPSON.

New York Botanical Garden.

April 6 and 13.—Subjects and lecturers to be announced later.

Members' Course—1899.

PROFESSOR ALBERT S. BICKMORE, Curator of the Department of Public Instruction.

Feb. 16 —Newfoundland and Labrador.
Feb. 23.—Gulf and River of St. Lawrence.
Mar. 2.—The Great Lakes.
Mar. 9.—Central California—San Francisco and Yosemite Valley.

PROFESSOR A. C. HADDON writes to *Nature* that the members of the Cambridge Anthropological Expedition to Torres Straits have now completed their investigations in the Straits. Dr. Rivers and Mr. Wilkin have left for England, while the other members of the expedition have proceeded to Borneo to study the anthropology of the Baram district of Sarawak. The health of the party has been excellent. The natives of Murray Island were studied with most detail, as, owing to their isolation, they have been less modified by contact with alien races. Some of the party stayed about four months on the island, while others had only a couple of months, owing to a trip having been made to the mainland of New Guinea. The New Guinea contingent visited the coast tribes between Kerepunu and the Mekeo district, and several excursions were made for short distances inland. There was not enough time spent at any spot for a thorough investigation of the natives, but a considerable amount of information was obtained in most of the branches of anthropology with which the expedition is concerned, which will prove of value for purposes of comparison. The researches on the Murray islanders were fairly thorough and will form a basis for comparison with the other islanders and allied peoples. Over a month was spent in Mabuiag (Jervis Island) by all the party, with the exception of Messrs. Myers and MacDougall, who had previously started for Borneo. Although the time spent in Mabuiag was short, a satisfactory amount of work was accomplished owing to the conditions being favorable. Observations were also made on several other islands in Torres Straits and Kiwai, which is situated in the mouth of the Fly River. A large number of photographs have been taken, and considerable collections have been made, which are now on their way to Cambridge.

IN a recent address before the British Ornithologists' Club Mr. Sclater, after referring to the expedition to Socotra and southern Arabia, with Dr. Forbes and Mr. Ogilvie Grant as its leaders, referred to other expeditions of British ornithologists. Captain Boyd Alexander, who has worked in the Cape Verde Islands, is struggling through the middle of Africa from the Cape to Cairo. Under present circumstances he seems likely to come out successfully, and will, no doubt, bring information on birds, if not specimens, with him. Mr. Lort Phillips hopes to return to his favorite quarters in Somaliland during the course of the present winter, and expects to get together the supplementary materials still required for the preparation of his proposed work on the birds of that most interesting country. Mr. John Whitehead, who has added so much to our knowledge of the zoology of the Philippines, proposes to return to the same country very shortly, in order to continue his researches in a field which he knows so well and in which he takes such great interest. Mr. Alfred Sharpe, C.B., who is shortly returning to his post in Nyassaland, promises to continue the employment of collectors in different parts of that Protectorate, the zoology of which he, following in the footsteps of Sir Harry Johnston, has already done so much to investigate.

WE learn from the *British Medical Journal* that an International Congress on Tuberculosis and the methods for combating it will be held in Berlin from May 23d to 27th next year. The Imperior Chancellor, Prince Hohenlohe, will preside, and will be supported by an influential committee, headed by the Duke of

Ratibon and Professor von Leydon. Five divisions of the subject have been agreed on: (1) Propagation, (2) Etiology, (3) Prophylaxis, (4) Therapeutics, (5) Sanatoria. Each of these questions will be introduced by a short and concise address, so as to leave ample time for free discussion and debate. Membership of the Congress is not to be confined to any particular class; any person interested in that terrible scourge of all nations, tuberculosis, can become a member by simply taking a ticket at the office of the Central Committee for Lung Sanatoria. As in the case of the Leprosy Conference a couple of years ago, foreign governments will be officially informed of the proposed Congress and requested to send delegates.

The Berlin correspondent of the London *Times* states that the official organ of the Prussian Ministry of the Interior gives some account of the work accomplished since its constitution three years ago by the German Central Committee for the establishment of sanatoria for consumptives under the protection of the German Empress and the presidency of the Imperial Chancellor, Prince Hohenlohe. The great object of the Central Committee was to promote the establishment of a sufficient number of sanatoria throughout the German Empire. Their efforts have been most successful, owing to the cooperation of wide circles of the public, and more particularly owing to the measures taken by the Imperial German Working People's Insurance Office in providing hospitals and convalescent homes for those of the insured who are attacked by illness and prevented from earning their living. A large number of sanatoria which are already receiving patients have demonstrated that Germans who suffer from tuberculous diseases do not require to go abroad in search of health, but can secure the best medical treatment in the immediate neighborhood of the place where they have to live and work. There will presently be some 50 sanatoria in Germany for persons in straightened circumstances. The Central Committee has cooperated in various degrees in the development of these institutions by placing at their disposal information and, where it was requisite, by making grants for their support. It has thus been found possible, while consulting in every case the special nature of local necessities, to establish the institution of sanatoria for consumptives in Germany on a sound and permanent basis. A meeting of the Central Committee, at which Her Majesty, the Empress, will be present, will be held on January 9th. President Gäbel, of the Imperial Insurance Office, will make a report on the new rules to be adopted, the object of which is to extend the sphere of the Committee's operations on the lines which they have hitherto followed.

UNIVERSITY AND EDUCATIONAL NEWS.

At the twenty-seventh convocation of the University of Chicago, on January 4th, President Harper announced two gifts of land, one by Mr. N. A. Ryerson, valued at $34,000, and one by Marshall Field, valued at $135,000. A gymnasium will be erected on the latter site. The enrollment of the University is 1,621, an increase of 450 over last year.

Mr. H. O. Armour has given $20,000 to Whitworth College, a Presbyterian institution at Sumner, Wash. The sum of $75,000 has been collected for Arcadia University, a Baptist institution at Wolfeville, N. S., $15,000 having been given by Mr. John D. Rockefeller.

The alumni of Harvard College, by a vote of 2,782 to 1,481, have reversed their previous vote extending the franchise in voting for overseers of the University to the graduates of all the schools. President Eliot and most members of the faculty who are alumni voted with the minority.

The annual catalogue of Harvard University records 411 officers and 4,660 students, an increase of 7 officers and 84 students over last year. These figures include the summer school, but not Radcliffe College, the enrollment of which is 411 students. There are 1,851 students in the College and 560 in the medical school.

The new catalogue of the University of Pennsylvania, about to be issued, will show that there are 258 officers and 2,790 students, of whom 1,337 are in the departments of medicine and dentistry. There are in the School of Arts 365, in the Towne Scientific School 284 and in the Department of Philosophy 158 students.